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Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 231.)

7. *The seventh objection is,* "That locks and dams will set a limit to the amount of freight which can be transported on the river."

In examining this we would call to recollection the fact that during about one-sixth of the time there will be a free, unobstructed navigation over the dams, both for ascending and descending craft; and that during half the time there will be a safe descending navigation over the chutes of the dams: it is believed that rafts may run them whenever they can run the Allegheny River, and that few *rafts* will pass through the locks. Much lumber will probably pass the locks in *barges* as a matter of choice. The coal business, as already suggested, will, from considerations of economy, be carried on largely through the locks in barges, towed by regular steam tugs; the barges will be arranged in fleets. The tug can take nine or more barges of 250 tons each, through a lock in 15 minutes. If we allow but one such fleet to pass per hour, it will give 54,000 tons per day, or an aggregate of eighteen millions three hundred and sixty thousand tons per year of 340 days! A quantity greater than is now shipped in the entire Union, on all the rivers, canals, and railroads. And yet but one-fourth the capacity of one of the double locks would be occupied. For the remaining three-fourths let us assume that four steamers may pass, each carrying 500 tons, or 2000 tons per hour, or 48,000 tons per day, or sixteen millions

three hundred and twenty thousand tons per year. Making an aggregate of thirty-four millions six hundred and eighty thousand tons; without counting any tonnage that would pass over the dams. And what sort of a "limit" is this? The Charleston and Memphis, Baltimore and Ohio, Pittsburgh and Connelsville, Pennsylvania Central, Allegheny Valley, New York and Erie, New York Central, and all the great Canada railroads united could not accommodate the half of such an enormous trade. With double locks fifty per cent. more could be passed. The locks are not made with chambers so large—350 by 65 feet, merely capacious enough for a given or expected tonnage, but for the accommodation of the larger size of Mississippi steamers, so that they need not necessarily break bulk between New Orleans and the head of the Ohio. Practically, this objection on the score of limit of capacity of the locks has not the least weight; for should the business ever increase to the capacity of the double locks, it could certainly afford treble or quadruple locks, if required.

8. *The eighth objection is* expressed thus: "What, I ask, would be the condition of things if one of the fifty dams, which it is so lightly proposed to construct on the Ohio, should be washed away, or undermined, and the navigation there suspended for four months?" This may be taken as stating that the undermining or washing away of a dam would suspend the navigation four months—or some long period of time. The writer will take direct issue on this point, and affirm from his experience, applied to such a system on the Ohio River, that such result *cannot ensue.* There is very little danger that dams properly built, will actually wash away. But suppose a dam did wash away; it would at least leave the river along that part as good as it was in its natural condition. Yes, it would leave it rather better, on account of the back water from the next dam below. It would require the washing away of two consecutive dams to bring the river along that part back to its natural condition.

A dam may be undermined. Suppose it to be so, so that for several hundred feet of its length, or its whole length, it should sink two or three feet below the regular height, what would follow, practically? The cause of such injury would of course be a flood. So long as the flood continued the *navigation* would not be *injuriously* affected (by the sinking of the dam) either through the locks or over the dam. The navigation would not be affected until the flood had subsided, and the water had fallen so low as to leave a scant depth at the entrance of the next lock above. But mark, in the very nature of things, this depth could never be *less* than it would be in the natural river in a similar stage of water.

By the time the water in the Ohio had fallen so low as to afford insufficient depth at the lock above, the superintendent would have control of the dam below so as to keep up the pool to a proper height to maintain the navigation until the permanent repairs of the dam could be made. And if an entire dam and the locks at the same were swept away, what would be the consequence? The objection raised is intended to convey the impression that the navigation would *cease*, that all movement of vessels and craft of every kind would be stopped for

months. We allege, positively, that it would not stop for one moment. The navigation along that particular portion of the river would continue as good as it was before the erection of the slackwater, and better. The peculiar advantage of the Ohio River slackwater, on account of its abundant supply of water, will be, that a serious injury of a portion of the works will not destroy the navigation. In almost any possible event, the repairing force on the improvement could, within 48 hours, make it passable for vessels, should an accident temporarily render it otherwise. Injury, so as to stop the working of both locks simultaneously—*at a time when steamers could not pass over the dam*—could alone stop the navigation. When the water was not high, such an event would be exceedingly improbable. The locks being all the same size and lift, the gates and all the parts of one would fit another. Ordinary prudence would dictate the keeping of a few finished gates and parts of gates, for such contingencies. In case all the gates of both locks should be carried away, an experienced superintendent could have one set replaced before the steamers should cease running over the dams; or, in case the accident happened at a low water period, within 48 hours after its occurrence. An objection to the Ohio slackwater on the score of liability to injury—*so far as the navigation* of the river is involved—has much less weight than a similar objection to any canal in the country, where a serious break would absolutely stop the navigation.

It is an objection, that any work, merely human, is liable to derangement; but to press this too far against proposed public works, is neither wise nor politic. With equal propriety we may figure each of the proposed artificial reservoirs, and the great dams, as tumbling to destruction, bringing ruin in their train. The writer presents no such fear as an objection to them, although it must be conceded by every engineer that dams 50 or 100 feet high require more care, precaution, and extra cost to guard against accidents, on account of the largely increased pressure from the additional head of water. If this eighth objection is to be regarded as of much consequence, it must follow, that the proposed high dams on the Allegheny must be discarded, leaving the artificial reservoir system dependent entirely upon a series of comparatively small reservoirs.

The dams on the Monongahela were tolerably well built; they can be better built on the Ohio. The experience acquired on the former and elsewhere, can be advantageously applied in making a more perfect improvement; and with double locks throughout, there should be much less trouble and detention on the Ohio.

9. *The ninth objection is*, "That the dams which it is proposed to construct on the Ohio River, will convert the channel of that river into fifty stagnant and pestilential ponds, endangering the healthfulness and diminishing the population of its valley."

This objection has been gravely set forth, without any reference, however, to evidence showing where, in any analogous case, such an effect had been produced. It appears to be purely speculative. As a positive and complete refutation of this mere assertion, we may point to the Lehigh, the Schuylkill, the Susquehanna, the Juniata, the Kiskiminetas, the Beaver, &c., &c.; the valleys of which streams, have become *more*

salubrious, more free from bilious epidemics, than they were prior to the erection of the dams. On the Monongahela, the health of the valley has been improved, and the population and business have been *immensely increased* in consequence of the slackwater. Mr. Ellet, in his original paper published by the Smithsonian Institute, took the correct, common sense view of this question when he said, "But the salubrity of rivers, when no longer subject to become dry, and have their sands and vegetable deposit exposed to the summer's sun, must necessarily be increased; for the same experience which teaches that large masses of fresh water, existing as lakes, are salubrious, also teaches that shallow stagnant pools, such as are found in the place of an exhausted river, are deleterious to health." This latter point of course had reference to the river in its natural state during periods of great drought.

The quantity of water that will be contained in the pools of the Ohio slackwater will be very great, and the healthfulness of the valley is much more likely to be improved than injured thereby. The ninth objection, on the score of health, appears to have less ground of support than any which has yet been named.

10. *The tenth objection is*, "That the delays at the locks will be greater than the running time now required to make the trip; and consequently the time now required for every ordinary voyage will be *more than doubled* by the detention at the dams."

This is a very strong statement, but fortunately it comes as a mere opinion. No attempt has been made to fortify it by facts, or from practical reasoning. *Facts*, go to prove the direct contrary, as will be shown. Facts, and legitimate reasoning, will both prove the reverse of the proposition so boldly put forth as an *objection* to locks and dams. We will first refer to a few facts furnished by a gentleman who, although not yet in favor of locks and dams for the Ohio River, is very familiar with the system and its operation on the Monongahela—Captain E. Bennett, who has been running steamers on that river almost ever since the completion of the improvement.—He says, "the time of running the 55 *miles*, including the passing of the 4 locks, varies from 6 hours down to 5 hours and 15 minutes by different boats. Generally it takes as long to go down as to go up. We count the time it takes, including all stoppages for freight and passengers, 8 hours up and 8 hours down. The average time required to pass each lock is from 7 to 10 minutes, but it can be done much quicker if required. A boat has been passed through No. 4 in a good stage of water in 2 minutes 20 seconds. We can land and put out a passenger and get under way again in from 2 to 3 minutes. Before the completion of the slackwater I do not recollect coming up (from Pittsburgh to Brownsville) in less than 12 hours, and frequently from 20 to 24." * * "We frequently make the trip, when the river is frozen to the thickness of three inches." * * "I think the ice does not form so quick in the pools in the first freeze as it did before the dams were built, owing to the greater body of water to be brought to the freezing temperature.

"I cannot say that the boats have been stopped by low water more than the summers of 1854 and 1856. In 1854 our boats were laid by 82 days, and a good part of that time there was no navigation for any

steamboat of lighter draft (our boat draws 3 feet light). Our locks and dams have not caused much detention by being out of repair. We are occasionally detained for a short time by something getting behind or before the gates so as to prevent their opening or closing." We may hereafter have occasion to refer more particularly to the opinion (expressed by Captain Bennett in his letter) against the introduction of locks and dams on the Ohio. At present we merely wish to investigate the objection raised on the score of "*delays*."

The average length of the pools on the Ohio, with 50 dams between Pittsburgh and Cairo, will be 20 miles. A steamer in a round trip would pass 100 locks. Allowing the loss of time in passing each lock to be 12 minutes (which experience proves to be a very liberal allowance), the entire lockage time would be 20 hours—10 hours down and 10 hours up. A part of this should not be regarded as lost time, as many of the locks will be established as regular "*landings*," for passengers and light freight, which will be transferred during the passage through the locks. But for the present, let it all go against the slackwater system as lost time. During a considerable portion of each year, that is, whenever there is not more than a foot or eighteen inches of water flowing over the wiers of the dams, the current in the pools will be very slight, so that the difference in the running rates of ascending and descending steamers will not be perhaps more than a mile an hour. And during this period the current is so gentle that steamers will land on their downward passage without losing time by rounding to. Assuming that there would be at least one intermediate landing, as frequently as every alternate pool, or once in 40 miles, it would give 25 descending landings per trip. Putting the loss of time caused by *rounding to* at 6 minutes, it gives 2½ hours saved in consequence of slackwater.

In he most favorable stage of the natural river, steamers on an average may run down stream about 14 miles an hour, and up stream about 8 miles an hour. The same steamers will *gain* much more in ascending through the pools than they will *lose* in descending the same. This is what experience and theory both establish. The difference even under the most favorable circumstances of the natural river, is at least worth noting; but as soon as the river falls to a 4 or 3 feet stage, this difference largely increases, in consequence of the delay in ascending the ripples, and in consequence of the delay in *descending* the same; for they dare not then run at full speed, to say nothing of the delays caused by grounding. The number of days when the water was below a 4 feet stage during the eleven years from 1838 to 1848 inclusive, was 1185, being an average of 108 days per annum. In one year, 1845, it was 139 days.

The number of days when the water was between 4 and 12 feet stage, was 2244, being an average of 187 days per annum, though in 1841 there were but 151 days. During the same period of eleven years, the average number of days when the stage of water was between 5 and 12 feet was 170, and between 6 and 12 feet, 146 days.

Navigation on the Ohio River may be roundly divided thus: 3½ months below 4 feet; 2½ months above 12 feet; and 6 months between 4 and 12 feet.

There will be 3½ months of the year when the slackwater will have

greatly the advantage in the *time* of a trip; six months when the time of a trip would be almost equal; and 2½ months when they would be just equal, that is, when the steamers would run over the dams. But we have another fact to consider, namely, that for 2, 3, 4, or even 5 months of some years, large steamers *cannot now run at all;* and also times when the very smallest class steamers, carrying at prices more than double or treble high water rates, cannot run.

It is therefore unfair and unreasonable, in comparing slackwater with the natural river, to set down the time of passing the locks against the former without bringing into juxtaposition the other facts, which go to show that that delay is fully compensated for. If we state the actual daily performance on the Monongahela, where the dams are one-fourth more frequent or closer together than they will be on the Ohio, we shall find that in a round trip they make better speed than is made on an average on the Ohio in the natural river. This is an actual fact, which cannot be overlooked. What then becomes of the assertion, "That the delays at the locks will be greater than the running time now required to make the trip?" It was obviously made at a venture, without much calculation or investigation, and the statement is contrary to all experience. It will be found on the Ohio, that although the downward passage in a good stage of water is made quicker on the natural river, that the upward passage will always be much quicker on the slackwater. It is easy to prove that this tenth objection, as stated, is a random suggestion: thus, the running time on an average, now required to make the round trip of 2000 miles, is, say, 80 hours down, and 125 hours up, equal to 205 hours: this gives a little more than 2 hours to each lock. According to this same sweeping mode of calculation, the *detention* alone at the Monongahela locks, ought to be over 16 hours; whereas, the steamers actually run the 110 miles, pass the locks, make all their landings, and complete the round trip in less than 16 hours! And yet these and similar assertions, must be gravely met, and their futility exposed, or they will be reiterated again and again.

11. *The eleventh objection is*, that "If dams are placed across the channel of the Ohio, all the trade of the river for 50 weeks of the year, will be forced through the locks." There are different ways of stating a question. This is one way. It admits, however, that there will be a *navigation* for 50 weeks of the year; the two weeks, it is presumed, being cut off on account of ice. Whereas, in the natural river, we have often no navigation. Now Mr. Ellet's calculations, and the records show, that for ten weeks there is a natural flow of over 12 feet water on the Wheeling bar, during which period all vessels can pass freely over the dams, without using the locks, if they should prefer it; and vessels of moderate draft may pass over them on many other days. As to being "forced" to use the locks, how gladly will business men avail themselves of the opportunity, when, without them, for so much of every season, they are now deprived of all navigation.

It is true enough, that even a perfect lock and dam navigation may not be so good as a perennial river with a steady six feet flow of water. Unfortunately, the Ohio River is very different from this. What value would a great railroad have, if it could only be used one half the year,

at irregular, uncertain periods: and a part of that time, with only half trains, &c., &c.? On the other hand, could the Ohio River be made constantly reliable, with a natural flow, its value would be almost incalculable. There may be other minor objections to a slackwater navigation on the Ohio River; but scarcely any that can be worthy of grave refutation. Objections may be raised against any proposed public improvement; but in regard to slackwater navigation, it should be kept in mind that it is no longer an experiment; experience has sanctioned and established it as highly advantageous in certain cases. The real question is, are the solid objections to its introduction on the Ohio so great, that it cannot be made practically advantageous on that stream?

In the Appendix to this paper will be found some information, derived from practical sources, which the writer thinks will aid in arriving at correct conclusions upon some of the leading points belonging to this discussion.

We may recapitulate the chief points which the writer regards as tolerably well established; and first, in connexion with the plan of

ARTIFICIAL RESERVOIRS.

That the annual flow of water in the Ohio at Wheeling if equalized is sufficient to afford a depth of 6 feet in the driest season.

That if "expense, damages, and health" be disregarded, it may be possible to construct reservoirs enough to effect it. That the estimate of the cost published by Mr. Ellet, is obviously altogether too low; and that even the greatly increased estimate of Mr. Morris, is quite short of the probable requirement.

That such large reservoirs as those described by Mr. Morris, cannot be advantageously located on the tributaries, and that sites containing all the elements designated, do not exist, either on the tributaries, or on the main streams; and that no where, above Pittsburgh, will six dams of 100 feet height contain half the quantity he has assumed.

That the advocates for artificial reservoirs, have made no allowance for evaporation between the reservoirs and Pittsburgh; although some of the reservoirs must be several hundred miles distant; nor have they made any allowance for the fact that on account of the greater declivity of the Ohio above Wheeling, a greater quantity of water will be required to maintain the same given depth.

That Mr. Ellet's estimate that 12 inches per annum from rains, &c., may be utilized, is safer than Mr. Morris's estimate of 18 inches; and that there are seasons, as shown by the flow at Wheeling, when even 12 inches would be an over estimate.

That the records at Wheeling, and the calculations of Mr. Ellet, prove that his proposed "regulating reservoirs" would be of no practical use in controlling great floods. That the two things—keeping up a regular navigation from reservoirs, and controlling floods—are incompatible; one demanding that the reservoirs shall be allowed to fill to supply the river in droughts, the other that they should be as nearly empty as possible, to be useful in holding back floods. The records show that in the great majority of floods, for eleven consecutive years, such reservoirs would have been full before the great floods came.

That to regulate the flow of the Ohio River to a uniform or to "nearly a uniform flow," would demand a vast array of reservoirs both on the main streams and on the tributaries; and that instead of being a "comparatively easy task," only requiring an expenditure "equal to a three years' cruise of three ships of the line," the cost would be enormous: and that such control of the Ohio could only be attained by the total destruction of interests greater than those it could by any possibility benefit; and that the same proposition, as applied to the Mississippi and Missouri Rivers, should fairly be regarded in an engineering sense, as *impracticable.*

And in all the foregoing calculations, the drainage of the entire area of territory above Wheeling, has been included; whereas, the actual drainage of the two rivers, Allegheny and Monongahela, is but a trifle over two-thirds of that area: almost one-third of the whole being derived from streams entering the Ohio River below Pittsburgh. The area drained by the Allegheny is nearly two and a half times that of the Monongahela.

Secondly. In regard to the plan of low open dams without locks.

That this is only to be considered as a modification of the plan of artificial reservoirs, and as a means of saving water; and that although such a system might be available on the Ohio where the declivity gradually decreases from 12 inches per mile to 3 inches per mile, it would not be applicable on rivers of greater descent.

That if the artificial reservoir system be adopted, then the plan of low open dams should be more carefully investigated on account of the promise it seems to hold out of saving so much water.

Thirdly. In regard to the proposed

System of Locks and Dams.

It seems to be demonstrated, that there is at all times, even in the driest season known, an ample supply of water for slackwater purposes without resorting to artificial reservoirs: and that this is also proved by records and measurements which are undisputed! And that for the greater portion of every year, there will be a very large daily surplus, which may be made available for hydraulic purposes.

That by means of chutes in the dams, the descending navigation may be kept good for rafts and arks at those periods when the Allegheny River is in a favorable stage for the passage of the same craft.

That the largest steamers and also steam tugs towing numbers of coal barges, may pass the locks; and that the amount of trade which can be conveniently accommodated with a system of double locks, is so enormous, that it presents no real practical limit.

That the probable cost of a slackwater improvement of the Ohio, can be obtained in advance, approximately, with greater accuracy than in the case of railroads or canals, generally: and that it is not likely to exceed $12,000,000; and that the annual cost of repairs will not be likely to exceed $110,000 per annum.

That a rate of tolls which will scarcely be felt, will handsomely sustain the works.

That during nearly two months of each year, there will be a safe

ascending and descending navigation over every part of the dams, when it will be optional for vessels to use the locks or not; that during three months of the year, or more, there will be a safe descending navigation through the chutes for rafts, &c.

That twelve feet rise in the natural river will create a depth of about five feet on the dams; 18 feet natural rise, about 9 feet; 24 feet natural rise, about 13 feet; 30 feet natural rise, about 18 feet; 36 feet natural rise, about 23 feet; 42 feet natural rise, about 29 feet; and 48 feet natural rise, about 35 feet on the dams. Thus, with the small rise of 12 feet, the dams will augment the height of the water above its natural elevation, more than six feet, while in the great flood of 48 feet, the dams would add only about one foot to the rise due to the natural river.

That always, before the locks will be submerged, the dams will be safely boatable, both for ascending and descending craft.

That injury to a dam can only improve the navigation *over the dam;* that it does not necessarily injure the navigation through the locks. A dam may be seriously damaged without interfering in the least with the navigation through the locks. Dams are not injured during low water; and not until the return of low water, could an injury to a dam affect the navigation at the locks: and then it is easy to keep up, temporarily, a sufficient height of water, until the injury may be repaired.

That nothing connected with a river lock, if properly constructed, except the gates, can be fairly regarded as liable to serious injury. And the locks being all alike, a few gates kept on hand, would obviate any great delay, even in the not very probable event of the destruction of the gates of both locks simultaneously. The loss of all the gates of but one of the locks, would cause no delay. Besides, such serious injury is only likely to happen during high water, when vessels would have free passage over the dams: giving time to perfect the preparations for the thorough repair of the damage.

That on a good slackwater navigation, taking the year round, first class steamers will make the trip between Pittsburgh and Cincinnati, or Cairo, &c., in *less time*, and at *less expense*, including tolls, than they can now; and that every steamer can make many more trips each year on the slackwater, than she ever could before. With the facility, certainty, and regularity secured by the slackwater, the aggregate annual trade will be immensely increased, requiring even more boats; each one more profitably employed than now.

That as a consequence of the increased safety and regularity, the rates of insurance may be greatly diminished. Collisions will be less likely to occur.

That the old fashion of conducting the coal business, between the Upper and Lower Ohio, and the Mississippi Valley, will, from choice, and from economical motives, be entirely abandoned. Barges will be substituted for the *frail arks*, which now not only never return, but in too many instances never reach their destination. Consequent upon this change, the coal business will rapidly and largely increase, beyond the calculations of the most sanguine—to the advantage of the consumer as well as the producer; regulating the price to a nearly uniform rate throughout the season, and incidentally giving the coal operators

more complete control over their mining hands: at the same time it will be better for the miners.

That the improved slackwater navigation will soon induce a considerable change in the mode of carrying on the *lumber trade.* Large amounts of lumber, logs, &c., will be taken from the water in the vicinity of Pittsburgh, to be seasoned and partially worked, and afterwards shipped on *barges* to the various points in the great Mississippi Valley; where the demand, to the third generation, must be an annually increasing one.

That the locks, in time, will all become passenger landings, as well as points for light freight, and many of them for general business; thus reducing to some extent, the number of other transient landings.

That it may be safely assumed that after the completion of a perfect slackwater navigation, the *average* rate of freights on the Ohio, and consequently between the Ohio and all points in the great valley along the rivers, will be *materially reduced.*

General Conclusions.

1. The writer has attempted to show to others, what he believes, that there are great practical difficulties in the way of so extensive a system of artificial reservoirs as would be necessary to supply the natural bed of the Ohio River with six feet depth of water all the year; nor does he assume by any means to have exhausted this branch of the subject. But if it can be shown that the reservoir system, *for such a purpose,* is really practicable, even at a cost of $20,000,000, the *cost* should not prevent its adoption.

2. The Ohio River has *four times* as much descent per mile between Pittsburgh and Wheeling, as it has near its lower portion below Evansville; it also becomes gradually wider, though not in proportion to the diminished declivity. From this, two things would seem to follow: first, that on the reservoir plan, it will require *more* artificial supply of water at the upper end than would be needed at the lower end, especially if, as we think, the lower portion of the river is better fed naturally from the side tributaries; and second, that on the slackwater plan it will require *less* water at the upper end than below, for two reasons—having shorter dams, causing less leakage—and narrower pools, making less evaporation towards the upper portion of the river.

3. After a complete investigation of the subject, it may be found, that the plan for keeping up the flow of the river in its natural state, may be regarded as impracticable; in that event it does not follow, that the plan of low open dams, requiring only *one-third of the water,* should also be deemed impracticable; the question might then stand between the plan of low open dams and the slackwater plan. If the water supply for the open dams should be demonstrated as fairly practicable at a reasonable cost, judgment might still be given in favor of the low dams without locks, notwithstanding certain objections.

4. It is obvious, that the necessity for a radical improvement of the Ohio, is becoming greater every year, with the increase of railroad facilities between the Ohio Valley and the Atlantic coast, and with the very general and truly wonderful annual increase of population and trade of the great Mississippi Valley.

5. That even at present, the aggregate annual losses to the cities, towns, and contiguous country directly interested, and mainly dependent upon the Ohio River as an avenue of commerce, added to the loss to steamboat owners, coal operators, coal dealers, &c., from the failure of a single season's navigation, such as occurred in 1856, would amount to a very large proportion of the gross cost of permanently improving the river. No fact seems better settled than this.

6. Whilst it is no easy task to determine how the river can be best improved, it is desirable that the subject should be investigated and reported upon in such a manner as *to command the respect and confidence of the country*. Experience, every where, teaches the danger of *merely* legislative decisions of such questions, though it is the legitimate province of Congress to provide for their thorough *investigation* and determination. Congress, at its last session, acted upon this subject; but owing to various causes, the bill which passed one branch, was not reached in the other, and failed to become a law. It is to be hoped that at the coming session a proper law will be enacted, providing for such an enlightened commission as will be able to settle the question finally.

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Although the quantity of water required to maintain a steady flow of any given depth through open sluices of regular width, may be calculated with considerable accuracy, yet in the case of an open river of an uneven section, irregular in width and declivity, it cannot be expected that any more than a rough approximation can be attained: more uncertainty must necessarily attend the measurements, and consequently, the results founded thereon. Whether this should operate in favor of, or against the proposed plan of supplying the Ohio River by artificial reservoirs, is a question which the writer leaves to the determination of others: all who have read Mr. Ellet's papers can judge for themselves. His calculations are based on measurements made at Wheeling, where the declivity of the river is considerably less than at a number of points above Wheeling. It seems fair to infer, that a quantity of water that would give six feet depth at Wheeling, would not give so great a depth at certain points higher up.

Upon a critical examination, it may be found that much more water would be necessary, than we have hitherto assumed in the course of this investigation, to secure six feet depth between Pittsburgh and Wheeling.

Again, respecting the drainage, Mr. Ellet remarks in regard to the drainage of 1844, which was 11·32 inches, according to his approximate estimate, that it is "almost precisely the amount ordinarily assumed by engineers as the supply that may be relied on for canal feeders, *but by no means that which ought to be uniformly anticipated.* There is, in fact, scarcely an approach to uniformity in the annual discharge of streams in this climate." Ample exemplification of this, as a general fact, may be seen on an examination of rain tables in almost any part of the world, where the rainfall has been registered.

Early European Views of Plans of Reservoirs for Supplying Rivers.

In a work written by Mr. Thomas Telford, about the year 1800, he discussed the question of the improvement of the navigation of the River

Severn. It is thus mentioned in Rees' Cyclopædia. "Mr. Thomas Telford has (page 288,) proposed another method of improving the Severn River, by collecting "the flood waters into reservoirs, the principal ones to be formed in the hills of Montgomeryshire, and the inferior ones, in such convenient places as might be found in the dingles and along the river. By this means, the impetuosity of the floods might be greatly lessened, and a sufficient quantity of water preserved to regulate the navigation in dry seasons, &c. This, it is thought, might even prove the simplest and least expensive mode of regulating *navigable rivers*, especially such as are immediately on the borders of hilly countries."

Mr. William Jessup, on another occasion, says, "rivers may be rendered nearly uniform throughout the year by reservoirs."

Mr. Rennie, an engineer of the first reputation in his profession, remarked: "After what has been said respecting the excess of flood water in the River Roch above the ordinary supply, the *idea of correcting the floods of the Severn* by reservoirs, must appear to be ridiculous."

The Severn, although a considerable stream in England, is greatly inferior in size, extent of drainage, height of floods, &c., to the Ohio. In its low stages, however, it assimilates very nearly to the low stages of the Ohio.

The whole length of the Severn, up to Welshpool, is 155 miles, while the Ohio, up to Pittsburgh, is 1000 miles. The highest floods in the Severn were about 16 feet—the average height of floods about 7 feet: while the highest floods in the Ohio are from 40 to 60 feet, and the average height of floods is over 20 feet.

There may be some rivers in England, and some in the United States, which would admit of material correction, or control, by means of reservoirs, but does it hence follow, that it is practicable to govern or control all rivers? The entire territory of Great Britain is much less than the area of country drained by the Ohio River. The drainage of the Ohio, above Wheeling, is about half the area of all England. When Mr. Ellet published his "Physical Geography of the Mississippi Valley," in 1849, he was not probably aware that the same plan for improving and controlling rivers, had been formally proposed, nearly sixty years ago in England, as above quoted.

There is some coincidence between the calculated drainage of the Thames River, in England, and the Ohio River above Wheeling, which may be worth a passing glance: thus, in England, with 6000 square miles of drainage, the average annual flow from the Thames, is assumed by Dr. Halley, at 166,624,128,000 cubic feet; the average annual flow as deduced by Mr. Ellet for the Ohio River drainage above Wheeling, (25,000 square miles,) is 835,000,000,000 cubic feet; one showing 27,770,688 and the other 33,400,000 cubic feet per square mile.

According to Mr. Ellet's calculations, to have regulated the supply of the Ohio in 1848, it would have required reservoirs capable of containing fifty per cent. more than *the entire flow of the Thames for a year*. But it has been shown in the text, that uniformity could not have been secured even with reservoirs of this great capacity.

APPENDIX A.—FALL OF RAIN IN VARIOUS PLACES, DRAINAGE, &c.

"The mean quantity of rain falling annually at 147 places, situated between north latitude 11°, and 60°, deduced from tables kept at those places, is 34·7 inches." (From a paper published by M. Cotte in the *Journal de Physique*, for Oct., 1791.)

"The mean annual quantity of rain is greatest at the equator, and decreases gradually as we approach the poles, thus at

Granada, Antilles,	12°	North Latitude	it is	126	inches.
Cape François, St. Domingo,	19° 46′	"	"	120	"
Calcutta,	22° 23′	"	"	81	"
Rome,	41° 54′	"	"	39	"
England,	33°	"	"	32	"
Petersburgh,	59° 16′	"	"	16	"

"On the contrary, the number of rainy days is smallest at the equator, and increases in proportion to the distance from it.

"From north latitude 12° to 43°, the mean number of rainy days is 78, from 43° to 46° the mean number is 103; from 46° to 50° it is 134." * * * "And more rain falls in mountainous countries than on plains."

We find in Gregory's Dictionary of Arts and Sciences, some interesting information compiled from the transactions of different learned societies, giving results shown by rain gauges kept at different places in England, through a series of years, varying from one to twenty-one years.

The average annual fall in 23 places, registered as *maritime* counties, was 38½ inches; while, in 7 places referred to as *inland* counties, the average annual fall was 24 inches.

Among the maritime counties, the highest recorded was at Keswich, in Cumberland County, 67·5, average of 7 years; the lowest at Carlisle *in the same county*, 20·2 inches one year.

At Liverpool, 18 years average 34·4 inches.

At Manchester, 9 years average 33·0 inches.

Among the inland counties, the highest recorded average was at Chatsworth, 15 years 24·8 ins., and the lowest at South Lambeth, 9 years 22·7 ins.

The mean annual average in London, 7 years, was 23 inches.

From the foregoing, it will be observed, that while in the maritime counties, the mean average in different places *varied* to the extent of 47·3 inches, the variation in the inland counties was but 2·1 inches; a remarkable difference, and the average mean annual fall in the maritime counties was 60 per cent. greater than in the inland counties. Thus, in a comparatively limited area, not exceeding that of one of our larger states, in thirty different localities, these great variations occur; some portions of the territory receiving more than three times the rainfall of other portions, even in the maritime counties; while in the inland counties there is a singular uniformity, and very much less rain. We infer that in making calculations for reservoirs in England, it would be necessary to attend critically to the records of a rain-gauge, or the measurements of the streams flowing from the particular regions in question.

In regard to a great number of local reservoirs to be established at widely separated points along the head waters of the Ohio above Wheeling, embracing an area nearly half as large as England, some attention would seem to be necessary to determine the local characteristics of each

separate region. We know from records kept by the United States officers at numerous points, that the variations in our country are even greater than they are in the European tables just quoted; running from 3 inches to 76 inches per annum; occupying, however, a much more extensive area.

On the Pacific coast, within 600 miles of each other, one post, Fort Orford, has the maximum 68·52 inches, and the other, Fort Yuma, the minimum 3·24 inches of the rainfall recorded.

The following Table is extracted from the "Army Meteorological Register," and presents the results at various points for 33 years, from 1822 to the close of 1854. It is only a portion of a larger table.

	Latitude.	Longitude.	Elevation above the sea in feet.	Average annual fall of rain in inches.
Fort Kent, Maine,	47°15′	68°35′	575	36·46
Fort Preble, "	43 39	70 20	20	45·25
Fort Constitution, N. H.,	43 04	70 49	40	35·57
Fort Independence, Mass.,	41 21	71 09	50	35·30
Fort Adams, R. I.,	41 29	71 20	40	52·46
Fort Hamilton, N. Y. Harbor,	40 37	74 02	25	43·65
Plattsburgh Barracks, N. Y.,	44 41	73 25	186	33·39
Fort Ontario, N. Y.,	43 20	76 40	250	30·88
Fort Niagara, "	43 18	79 08	250	31·77
Allegheny Arsenal, Penna.,	40 32	80 02	704	34·96
Carlisle Barracks, "	40 12	77 14	500	34·01
Fort Mifflin, "	39 53	75 13	20	45·27
Washington, D. C.,	38 53	77 02	70	41·20
Fort Monroe, Virginia,	37 00	76 18	8	50·89
Augusta Arsenal, Ga.,	33 28	81 53	600	23·00
Fort Pierce, East Fla.,	27 30	80 20	30	62·98
Fort Pike, La.,	30 10	89 38	10	71·92
New Orleans, La.,	29 57	90	10	50·90
Fort Smith, Ark.,	35 23	94 29	460	42·10
Fort Gibson, Ind. Ter.,	31 47	95 10	560	36·46
Jefferson Barracks, Mo.,	38 28	90 15	472	37·83
St. Louis Arsenal, "	38 40	90 05	450	41·95
Detroit, Michigan,	42 20	82 58	580	30·07
Fort Mackenac, "	45 51	84 33	728	23·87
Fort Winnebago, Wis.,	44 30	88 05	620	34·65
Fort Des Moines, Iowa,	41 32	93 38	780	26·56
Fort Atkinson, "	43	92	700	39·74
Fort Snelling, Min.,	44 53	93 10	820	25·43
Fort Leavenworth, Kan.,	39 21	94 44	896	30·29
Fort Kearney, Nebraska,	40 38	98 57	2360	27·98
Fort Laramie, "	42 12	104 47	4519	19·98
Fort Worth, Texas,	32 40	97 25	1100	40·86
Phantom Hill, "	32 30	99 45	2300	17·22
Fort Croghan, "	30 40	98 31	1000	36·56
Fort McIntosh, "	27 31	99 21	400	18·66
Fort Webster, New Mex.,	32 48	108 04	6350	8·79
Fort Conrad, "	33 34	107 09	4576	6·76
Albuquerque, "	35 06	106 38	5032	9·42
Fort Yuma, California,	32 43	114 36	120	3·24
Monterey, "	36 36	121 52	140	12·20
Fort Humboldt, "	40 46	124 09	50	16·77
Fort Orford, "	42 44	124 29	50	68·52
Fort Dallas, Oregon,	45 36	120 55	350	14·32
Fort Steilacoom, Wash. Ter.,	47 10	122 25	300	51·75

The great variations exhibited between points but a few miles apart, prove the same thing shown by the records of the flow of water at Wheeling; that the rainfall is entirely irregular, and that the results obtained from the most careful observations at any given locality, cannot be assigned to any other point. Hence, in the opinion of the writer, an extended system of rain gauge observations among the head waters of the Ohio, would not be likely to present any more reliable data than the records of the actual flow at Wheeling already shown, except for special localities. Indeed, this would seem to present a better approximation for general calculations, considering the object in view, than the records from rain gauges.

Mr. Ellet makes the annual average flow at Wheeling equivalent to a depth of 14·778 inches over the whole area of country drained. But one year, 1845, gave but 9·83 inches. In 1844, it was only 11·52 inches. Thus two consecutive years gave less than 12 inches.

In calculations designed to form the basis of a system dependent *entirely* upon the annual downfall of water, would it not be prudential to assume the *lowest* annual result, as an event to be anticipated? Thus, in placing a reservoir, we should allow sufficient area of territory above the dam, to barely fill it once a year with the minimum of 9·83 inches, in preference to assuming the larger result, 18 inches: otherwise, we may expend money uselessly. In the absence of long continued observation of the actual fall in any given locality, this would appear to be the only safe guide.

In regard to the great reservoirs proposed on the main navigable rivers, it is different, because we know beforehand, that all of them combined, will not contain the drainage of the driest year.

There is another point connected with the failure of water and storing up in reservoirs, not adverted to by the advocates of the artificial reservoir system. Having theoretically set apart 3600 square miles (out of about 25,000 square miles,) which represents the artificial source of supply needed to maintain a six feet stage in the river for a given number of days, it must follow, that it will not be quite sufficient in practice. If this additional supply originated outside of the area already included, the calculations would be correct, but being a part of the same natural flow, the retention of one-seventh would add a per centage of days to the low water period.

In 1845, had the whole drainage been stopped in one immense reservoir, and drawn out daily in equal quantities throughout the year, it would have afforded only 7 feet depth on the bar at Wheeling. And yet there was not a single day that year, when it was less than 2 feet 4 inches, and not a month, when the average was less than 2 feet 10 inches on the bar.

From these considerations, we think that an assumption of 12 inches per annum as the downfall of water that may be utilized in reservoirs in the region named, is quite liberal enough.

(To be Continued.)

For the Journal of the Franklin Institute.

Railroad Bridge Drill, or arrangements for the speedy erection of temporary Bridges on Railroads. By Col. Franklin Hewson, Civ. Eng.

(Reported from personal inspection by Ellwood Morris, Civ. Eng.)

The Reporter having lately witnessed one of Col. Hewson's, "*Bridge Drills*" at Mount Carbon, Schuylkill Co., Pa., requested of him explanatory sketches, and descriptions of these interesting manœuvres, which we now have the pleasure of laying before the readers of the *Journal*.

The general use of timber bridges upon the American railroads, is attended with great inconvenience and loss upon railways of heavy trade, when such bridges are suddenly destroyed by fire or flood, as sometimes happens; and perhaps the more frequently from the former upon roads transacting the largest business.

To have at hand the means of speedily repairing such disasters, by double track temporary bridges of adequate strength to carry the heaviest locomotives, it is often a matter of great consequence, especially to railroads doing a heavy mineral business, on which the sudden destruction of a bridge may disorganize the entire trade in all its extensive ramifications, by land and water, from the mines even to the distant consumer.

The business of a great mineral railroad sometimes exceeds $12,000 a day, or $500 an hour, on such works, the value of *time* is immense, and the necessity of restoring with dispatch, the continuity of the line in the case of an accidental break, is correspondingly great.

This has led the superintending engineers in charge of such works, to consider closely the best means of speedily restoring the track, when broken by the destruction of a bridge

In 1850, Col. Hewson had to replace by a substantial trestling, a bridge of about 150 feet span over a chasm 30 feet deep, upon a double track railway; and though he conducted the repair with characteristic energy, it required 72 hours of time, 1562 days' work of men, and an outlay of $3873, to restore the double track over the Schuylkill River at Mount Carbon, (the place referred to,) where the bridge was suddenly swept away by a tremendous flood.

Upon *four* occasions in Col. Hewson's professional experience, he had occasion to notice that the great expense and loss of time in restoring a broken communication over a river, with a double track railway, was caused:

1. By the difficulty of collecting the necessary force, timber, and other materials, and dispatching the same to the scene of disaster.

2. By the enormous prices which had to be paid for lumber, &c., in consequence of the sudden and peremptory demand.

3. By the want of adequately skilled labor, and the confusion incident to the necessary employment of large bodies of inexperienced men, at high rates of wages.

4. By the want of proper appliances for loading, conveying, unloading, framing, and raising the trestle bridges, at the site of the break.

To remedy these evils, as far as practicable, he was led to provide *a magazine* of all of the necessary materials, in a position to admit of

being promptly loaded on a railroad train, and to project and organize a system of "*Bridge Drill*," (the subject of the present paper,) under which, a body of sixty men of the permanent roadway force assembled at one point—*at the magazine of materials in fact*—under the direction of the master carpenter of the road, were enough with the assistance of a locomotive train, to load, convey to the scene of action, and erect in a few hours, a substantial trestle bridge, in place of any of the regular railroad bridges, lost by fire or flood.

Col. Hewson has prepared at the carpenter shop of the roadway department of the Upper Schuylkill railroads, above Pottsville, all the materials of wood and iron, all the cross-ties, rails, spikes, &c., all the stone for crib abutments, and other things necessary to form a double track trestle bridge 150 feet long, over a chasm 30 feet deep, of adequate strength to carry the heaviest locomotives and coal trains moving upon it, in opposite directions at the same moment, on the two tracks.

The bulk of the materials are piled *over* a side track upon cross-beams, elevated so as to allow a train of 8-wheeled trucks to be backed under them, forming ten piles of an aggregate length of 342 feet, as shown on Plate No. II., Fig. 1.

In the vicinity of these piles, with a railroad track along its front (to facilitate loading), is a building called the "*equipment house*," where there are stored for use, in a systematic manner, the hoisting machinery, levers, ropes, tackle blocks, bolts, spikes, washers, chairs, gauge bars, and all the tools and implements which experience has shown to be necessary for the erection of double track trestle bridges for railways over rivers—the number and quantities of these necessaries, are fully developed by the "*drills*," and this is one of the advantages of periodic drills; another is, that it enables a small body of men drawn from the ordinary roadway force, by being accustomed to act together, and drilled to particular duties, to perform a great amount of labor, and to restore a destroyed bridge with uncommon dispatch.

The operations we are describing, commence with the assemblage of 60 men at the magazine of materials, under the lead of the master carpenter, and the arrival of a heavy locomotive engine with a train of 15 eight-wheeled trucks, or flats—two of these are placed in front of the "*equipment house*" to receive the hoisting gin, and the small materials, while the other thirteen trucks are backed by the engine, *under* the piles of bridge materials shown in Plate II., Figs. 1 and 4. What follows will be best understood by reference to Plates II and III, and to the subjoined descriptions.

Before giving these, the Reporter will mention here, that Col. Hewson acknowledges in proper terms, the great assistance he has always derived in the bridge drill, and other arrangements—from Mr. Waters S. Chilson, the master carpenter of the Upper Schuylkill railroads, who invented the ingenious hoisting gin, which has been found so efficient in practice, and who was also of great service in the adjustment of other important details—and the Reporter adds, with pleasure, his own testimony to the merits of this skilful mechanic and rigger, who is well known at Pottsville by his successful execution of some very difficult problems in hoisting.

In the event of the abutments of a bridge being swept away, as well as the bridge itself, temporary abutments are erected of crib work, filled with stone. The timber and rag bolts for this work form part of the magazine of materials, and the stone is on hand also in self-discharging bins at a proper elevation above the track, as shown upon Plate II, Fig. 2.

Every thing necessary, in short, is provided and arranged beforehand, and it only remains to supply the manual labor to put the parts together, and the locomotive power requisite for transportation.

Explanation of Details in the Plates.

Plate II, Fig. 1, represents the sections or piles of timber in their order of arrangement in the yard, ready to be lowered on trucks.

Fig. 2, a bin for holding stone to be used in crib-work for foundations, for temporary piers and abutments, &c., &c., capacity $4\frac{1}{4}$ perches. The floor of the bin is at an angle of 13°. The stone is discharged into the cars over an apron, *a a*, which works upon hinges, and is elevated or depressed by means of a rope *b*. Ten bins of this description have been constructed.

Fig. 3, a pile of timber in readiness to be loaded on a truck. The bearer, *a a*, supporting the pile, rests on movable blocks *b b*, placed on top of standards, *d d*, oak levers *e e*, work slides *c c*, raising or depressing the bearers *a a*, the fulcrum *f* of lever is spiked upon the bottom sill of the standard—the grapling rope with a hook at one end is linked by hand to staple *g*, driven into one end of the bearer.

Upright stays *m m*, Fig. 4, prevent the timber in the pile from falling off, they are inserted at each end of the rockers *k k*, these rockers, when the pile is loaded, rest upon the floor of the truck—they are secured from falling, by iron catches or dogs, driven into the outside bottom stick of the pile at *p p*, a $\frac{3}{4}$-inch rod *l l*, keeps the upright stays *m m* from spreading.

Plate III, Figs. 6, 7, 8, show the details of gin, *a a* being the purchase spar, *b b b*, the sheaves in the purchase spar, *c c* the fall or rope 4 inches in circumference, *d d*, the rollers thrown in and out of gear by levers, *e e*, by means of which, the gin can either be put in motion or fixed at rest, *g g*, boxes carrying sledge hammers and spikes, *h h*, check chains to keep the gin from capsizing when in motion.

m m iron truss rods for strengthening the purchase spar, *k k* chains to be detached for hitching to trestle.

Fig. 9, shows a number of trestles erected, and also the arrangement for crossing a canal or passage way of 45 feet clear opening, (should this contingency arise,) in such case a framed beam *b b*, with an arch attached to each side, is placed under each line of the rails in the track, the top and bottom chords are 12 ins. by 14 ins, bolted together through blocks *c c* to the approximate outline of a parabola—these beams are all prepared as per sketch, except the closing pieces *d d* of the arch, these are put in after the beams are on the trestle—*e e*, &c., are braces to resist the thrust on the trestle *f*, temporary light trestles of 6 ins. by 8 ins. timber occupy the channel for a short time, until trestle *f* is erected, and the beams are run upon it.

When no *passage way* is to be kept open, trestles *h* are used exclusively, the rail-joists, *k k*, being 12 ins. by 14 ins. and the bolsters

ll, 12 by 14, 8 feet long. The span between centre and centre of the usual trestles *h*, is 12 feet.

Plate II, Fig. 10 is a section of trestle *h*. The cap pieces *a a*, are prepared with mortises at *b b b b*, to receive the posts *c c c c*, which are framed with appropriate tenons—the outside posts have a batter of 3 ins. to the foot. The posts, after being sawed to the necessary length, (to be ascertained by soundings at the time,) are secured to the bottom or mud sill, *d d*, by means of cast iron knees *f f f f*, spiked to both the post and mud sill—a bolt is also driven from underneath the mud sill into the posts—the rails for the track rest upon chairs $2\frac{1}{2}$ feet apart, spiked upon the rail-joist, an iron strap resting in a groove in the chair keeps the tracks and the joists from spreading, and act as gauge bars. The substitution of the cast iron knees for the mortises and tenons in the mud sill and posts ; the use of the chairs, to avoid dressing off the joists to receive the iron rails, will save much labor and delay in the completion of the work.

Fig. 11 shows the manner in which the knees are attached to the mud sill and outside post.

Fig. 12 is a section of the knee for the upright posts.

Fig. 13 is a plan of knee.

Details of the Loading Manœuvres.

There are 10 sections or piles of timber and materials whose aggregate weight amounts to 94 tons (of 2240 lbs). The weight of heaviest section $= 13\frac{1}{4}$ tons.

Each section, except No. 3, has two bearers, 4 movable blocks, 4 standards, and 4 levers. Section 3 requires 3 bearers, 6 movable blocks, 6 standards, and 6 levers.

The force employed at the loading manœuvre = 48 men placed at the outset in the following positions; 7 men to each lever, and one man to each block on section No. 1.

7 men to the intermediate lever, and one man to the corresponding block on the right and left flank of section No. 3.

The train of empty 8-wheeled trucks being backed under the suspended piles from 1 to 10. The foreman takes position on top of section No. 1, and gives the following command. *Section, are you ready? Bowse! Draw blocks!! Plumb up!! Draw levers! Forward!* Same process repeated at ensuing sections.

After section No. 3 is loaded, the intermediate lever men led by their block tenders, drag out the bearers which have fallen upon the tracks, by the aid of short ropes armed with hooks, which they attach to iron staples at the end of the bearers.

Time occupied in loading the 10 piles is three minutes. Their weight is 94 tons, as above stated; while this is in progress, six men load the gin and tools from the equipment house. The locomotive train now loaded, with all the materials necessary for the erection of the temporary bridge, proceeds to its destination.

Unloading and Framing Manœuvres.

Two active men remain upon the trucks to unload—the framers and timber carriers are drawn up at the foot of the embankment, beyond the

reach of the falling timbers, in two files about 10 paces apart, in right and left open order, facing inwards.

The timber and apparatus being unloaded in the following routine.

1st. The float and boat poles are seized by a gang of 12 men and launched upon the water, with a party to take soundings. The balance of the men remaining as they were, until the timbers and plank are unloaded. The planking on which the trestles are framed and launched, are seized and laid down on the ground leading to the water's edge—then the mud sill of trestle placed within three feet of the water—then the uprights or posts and cap pieces which are put together and launched.

12 men are employed in carrying the timbers composing the trestle—8 men frame them together; these two forces also launch the trestle and 3 men float it to the hoisting gin.

GIN MANŒUVRES AT THE ABUTMENT AND IN RAISING THE TEMPORARY BRIDGE.

After the gin is launched from the cars, the following commands give the order of its movements.

1st, *Lock levers!* (done by throwing rollers in gear.)
2d, *Forward!*
3d, *Halt!*
4th, *Spring levers!* (by throwing rollers out of gear.)
5th, *Secure purchase spar!* (lashing down the rear end of the purchase spar to the track sills, or some other suitable object.)
6th, *Overhaul tackle and attach trestle!*
7th, *Bowse on the fall!*

When the trestle is erected in its position, the following orders are given:—

1st, *Secure trestle!* (spiking down stays of 3 by 10 inch plank, leading from abutment to cap piece to keep the trestle from falling.)
2d, *Adjust skids for gin!*
3d, *Detach purchase spar!* (unlashing the fastenings at its rear end.)

6 men work the gin, who also put down the stays, adjust the skids, and lash and unlash the purchase spar.

20 men haul upon the fall.

When the three first trestles have been erected, organized parties follow the wake of the gin with the bolsters and rail-joists. 4 men fit down the bolsters, and 8 men deliver and lay down the rail-joists.

The bolsters are carried with the rail-joist on timber carts, which are run upon 3-inch plank, extending from trestle to trestle.

8 men follow the rail-joists with the track laying.

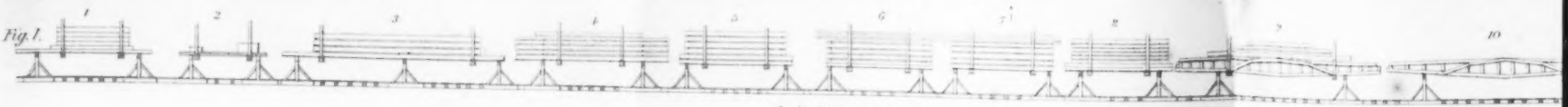
Time unloading, framing, launching, and erecting 3 trestles,	28 minutes.
Time laying down the rail-joists and tracks, . .	20 "
Total time of completing one-fourth, of 150 feet span with the tracks laid—54 men employed,= . .	48 minutes.

This is the time actually occupied in the drills for exercising the men.

At the same rate as above, the double track railway communication over a chasm 150 feet wide, and 30 feet deep, would be restored in 192 minutes—but, to cover all contingencies, we will say *six hours*.

TEMPORARY BRIDGE EQUIPMENTS.

Fig. 1.



Scale 25 feet to an Inch.

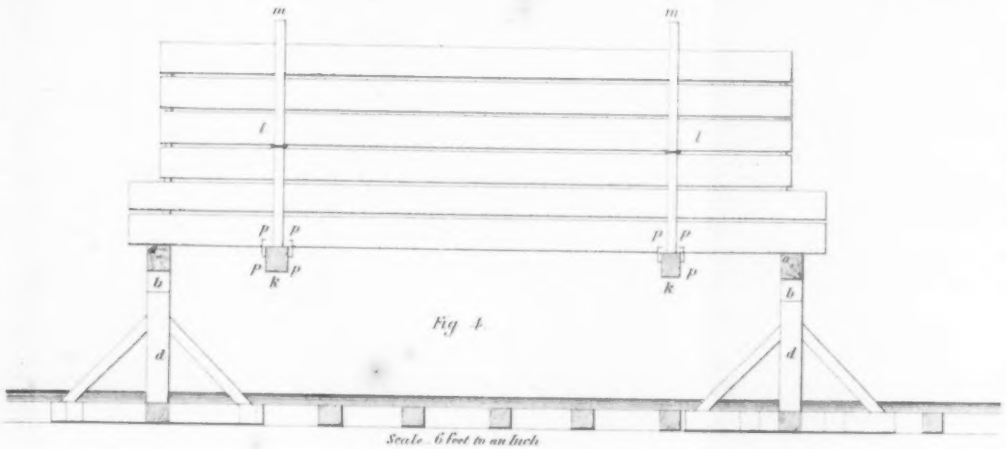
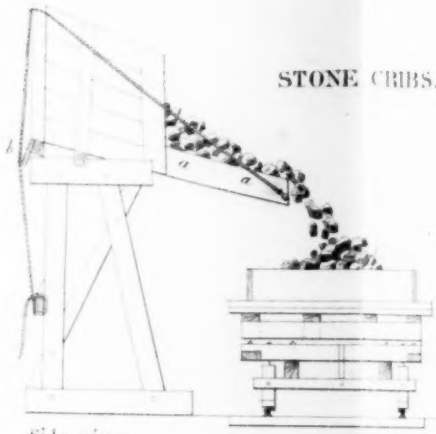


Fig. 4.

Scale 6 feet to an Inch.

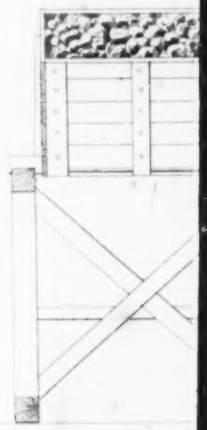
ELEVATION.

STONE CRIBS.



Side view.

Fig. 2.



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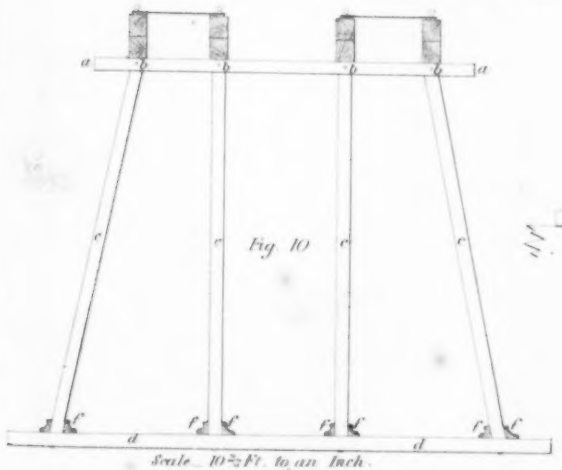


Fig. 10

Scale 10⅔ Ft. to an Inch.

SECTION OF TRESTLE

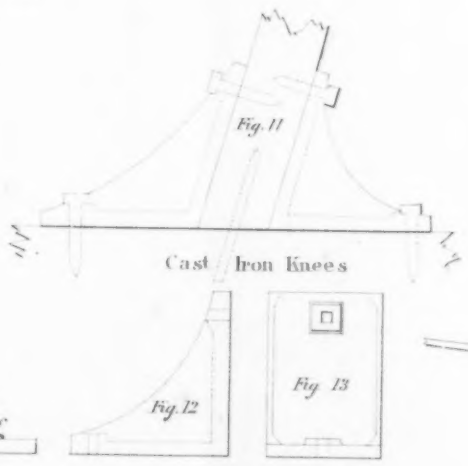


Fig. 11

Cast Iron Knees

Fig. 12

Fig. 13

Scale 2⅔ Inches to a foot

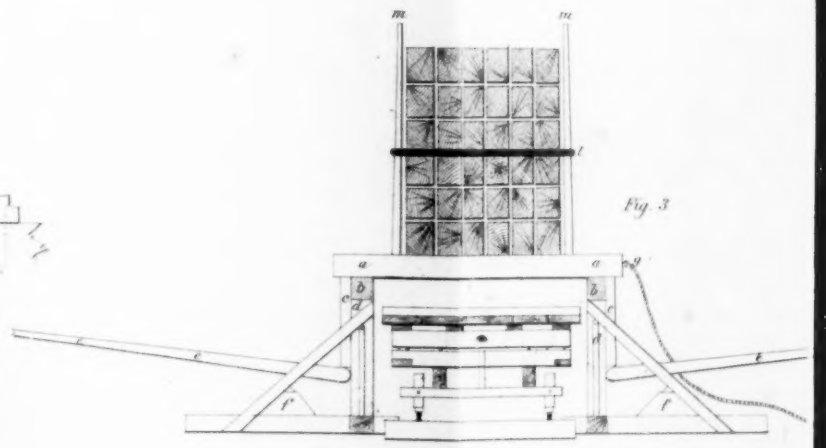
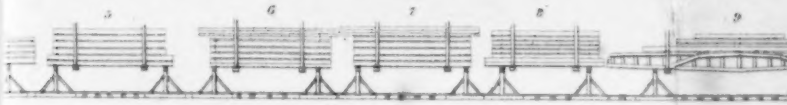


Fig. 3

SECTION.

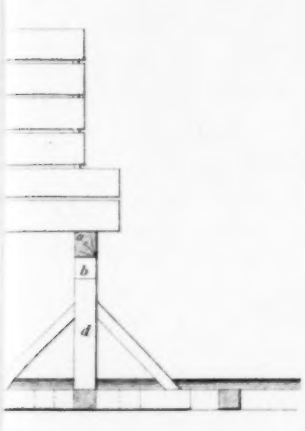
Scale 6 feet to an

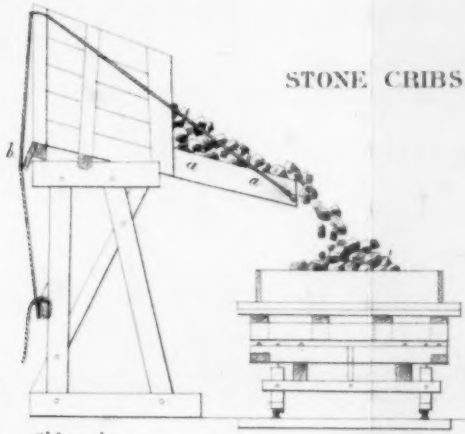
TEMPORARY BRIDGE EQUIPMENTS.



Scale. 35 feet to an Inch.

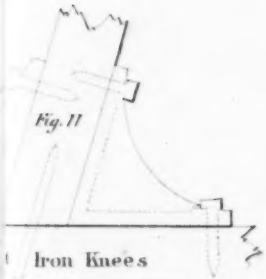
STONE CRIBS.



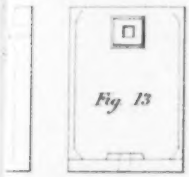


Side view.

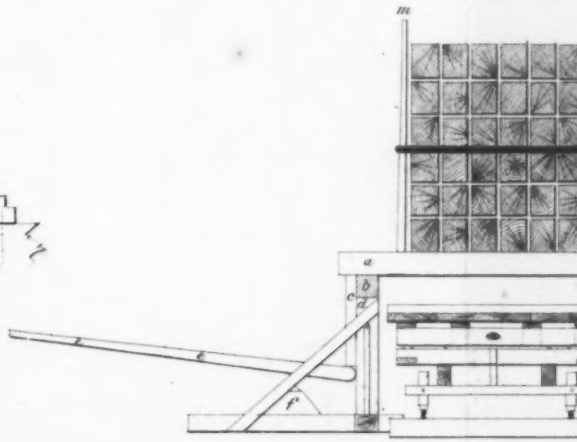
Fig. 2.



Iron Knees

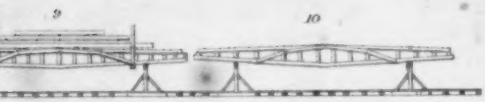


le 2½ inches to a foot

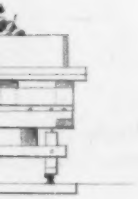


SECTION.

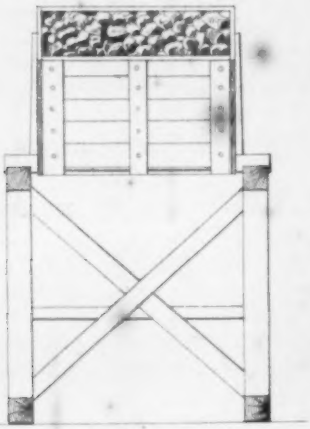
T. Sunderland lith. Phila.



CRIBS.



g. 2.



Elevation.

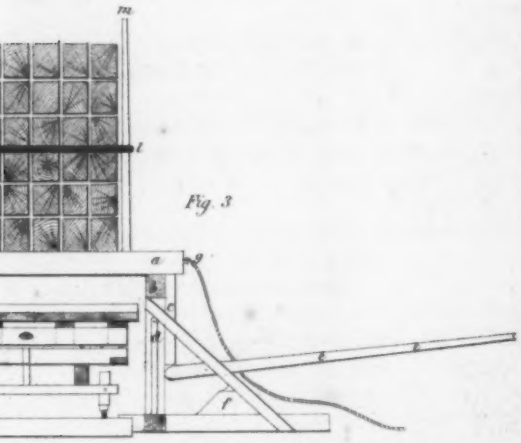
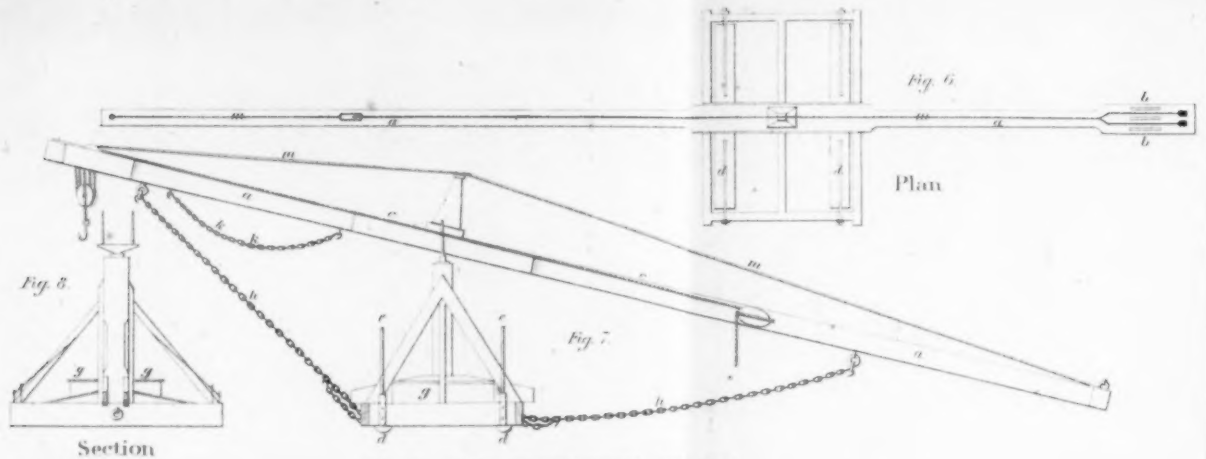


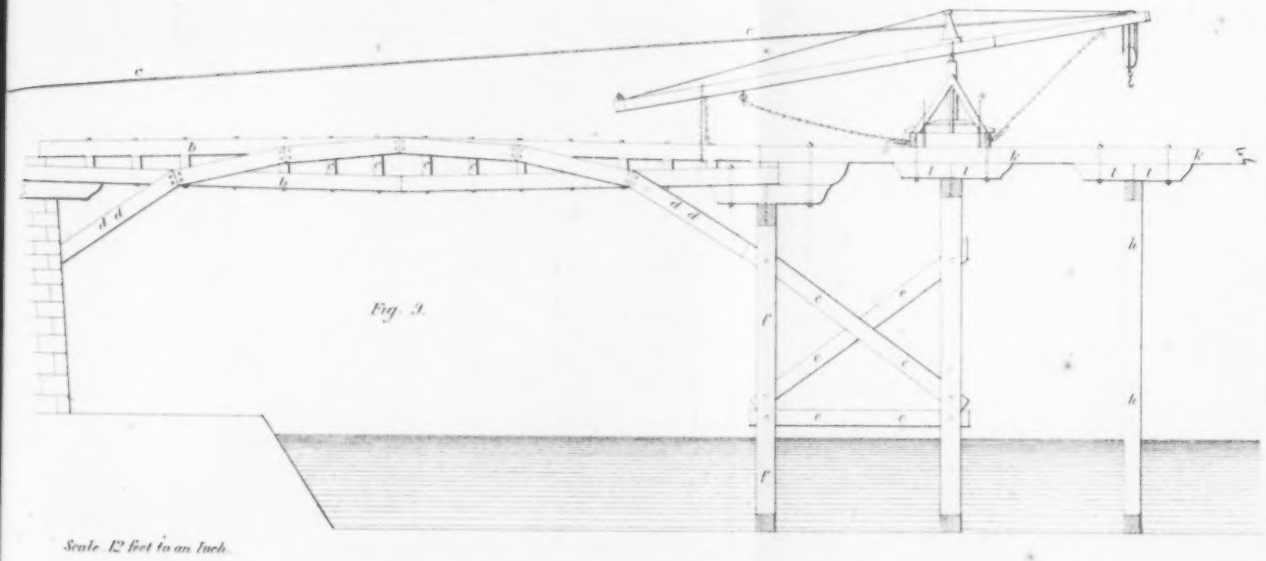
Fig. 3

ECTION.

Scale 6 feet to an Inch



PLAN AND ELEVATION OF GIN.



ELEVATION OF TRESTLE.

To restore, by means of the preparation, and the drill, in six hours, with 60 men, a broken communication, which has been ascertained on another occasion, to have required 1500 days' work of men, and 72 hours of time, is certainly an important achievement, one that deserves the attention of railroad men, and which must redound to the credit of Col. Hewson, the engineer who devised this "*Railroad Bridge Drill.*"

For the Journal of the Franklin Institute.

On the Failure to Lay the Submarine Cable. By A. C. JONES, Engineer.

Notwithstanding the array of great names, and the much ado about performing so simple an operation as the paying out of a wire rope, (for to call it a cable is a misnomer,) from the stern of a large ship, which, from its length, can be but slightly acted upon by the waves, yet, *in the absence of a gale of wind*, the laying of this cable has resulted in failure from a want of foreknowledge, proper mechanism, and judgment to meet emergencies, such as should have been expected.

The extracts following, were written on the day of the receipt of the telegraphic report of the breaking of the "cable," and were published next day in the "*Ledger*" of this city. As my position, then taken, has been confirmed by subsequent news, I incorporate a portion of these remarks in this paper.

"The '*Times*,' and writers on the other side of the Ocean, speak of the '*ponderous machinery and supporting beams*,' of the paying out apparatus; this ponderousness (being one of the characteristic features of English machinery,) is, no doubt, true in this case. Now, what was the work this 'ponderous' machinery had to do? Simply to govern the speed of a wire rope not exceeding in tensile strength an iron wire three-eighths of an inch in diameter, running out at about the speed an active man can walk! At the start, '*the cable ran off the groove of the pulley, got jammed and broke.*' If a cable was to have been laid in a mill-dam, an open sheave would have sufficed, but on the ocean, where yawing and pitching must have been expected, this was a culpable blunder. To provide a safe fixture, it was not necessary to invent, but to take the 'four-sheaved guide,' (no novelty in the United States,) in which two pulleys are horizontal, and two vertical; their four peripheries running together, form a hole for the rope to run through. If (one or more) such guides had been used, let the ship pitch or yaw ever so much, the '*getting off*' of the cable would have been impossible."

And yet this slipping off of the sheaves in the "Cove of Cork," did not cause any precautions to be taken against a similar mishap for only *nine and a half hours before the final rupture.* Prof. Morse writes,*

"We have just had a fearful alarm. Stop her! stop her! was reiterated from many voices on deck. On going up I perceived the cable had got out of its sheaves, and was running out at great speed. All was confusion (!) for a few moments."

"By rope stoppers, the cable was at length brought to a stand still, but it strained most ominously, perspiring at every part large tar drops. But it held together long enough to put the cable on its sheaves again."

"There was no difficulty (before starting) in testing the cable, to determine the tensile strain it would bear *without injury to its conducting powers.* Was this done, and provision made that this strain shall not be *exceeded* when paying out the cable? No, for the brakes were applied with so little judgment, that the *whole strength* of the cable was overcome, and the undertaking brought to a stop.

"The amount of the safe maximum strain being determined, and the paying out machinery being of a light character, in *proportion* to the 'cable,' if this regulating apparatus had been placed on guides, or had been pendulous, and attached to a permanent

* Published in the *New York Observer.*

frame by a *dynamometer*, then there would have been no *guess work* when the brakes were applied, for the dynamometer would indicate the exact strain on the cable, and *this strain should regulate the friction of the brakes, without regard to the speed of the ship.*"

Again, Prof. Morse states,

"At 3h. 45m., A. M., Mr. Bright, the engineer, went on deck. Our ship was going on at the rate of four miles two fathoms per hour, and the cable running out at a greater speed; perhaps at the rate of five miles per hour. Mr. B. spoke to the man in charge of the brakes, asking him what strain was upon the cable, to which the answer was returned, about 3000 lbs. Mr. B. directed him to put 100 lbs. more of force upon the brakes, to check the speed of the cable. This was demurred to by the man for the moment, who expressed a fear that it would not be prudent. Mr. B., however, persevered in his orders. The brakes were applied with the additional force, which suddenly stopped the wheels of the paying out apparatus, and, of course, brought the force of the unchecked speed of the ship as an addition to the strain. At this time, too, there was a moderately heavy sea, and, at the rise of the stern by a wave, the cable parted."

"Was there judgment in this? The survey of the bottom has not been so general as to gainsay that there are sudden depressions not yet discovered, which would require more cable than was due to the speed of the ship. But throwing this theory out, every one conversant with the ocean, knows that surface currents are common, and that the speed of the ship through the water and over the ground differs. Again, *deep currents* are known to prevail, and suppose the cable was under the influence of a current, it would be swept out of the direct course, and *more* would be required to be paid out than was due to the speed of the ship." This seems to have been the case at the time of the breaking of the cable, for a subsequent report states, "a lateral current was encountered, which swept the cable out of its direct course: and this report also, gives the position of the other ships at the same time, and it shows that they were mere lookers on. So far as conclusions can be drawn from what had been done, it was the intention to *run an air line course* regardless of currents, &c. Now, as many currents, having different directions, should have been expected on the route, what was the duty of the attending steamers? Common sense would point out that they should act as pioneers, going ahead, proving both deep and surface currents, and by a proper mode of signals, notify those on the '*Niagara*' of their course and strength, and then the direction of that ship could have been such as to neutralize their force. Supposing a man in a boat should wish to lay a wire across the river at a time the tide was running down, if he had any practical judgment, would he row *straight* across, instead of at an angle up stream, when *his course in the boat* would be represented by the arc of a circle, whilst the wire would fall to the bottom in nearly a direct line from shore to shore?"

Prof. Morse also states that,

"We got an electric current through till the moment of parting, so that electric connexion was perfect, and yet the farther we paid out the feebler was the currents, indicating a difficulty, which, however, I do not consider serious, while it is of a nature to require attentive investigation."

It appears that 3100 lbs. was the maximum strength of the cable, for at that strain it broke, and as it had been kept to within 100 lbs. of this breaking point for some time before; and when the cable got off the sheaves before the final rupture, "*it strained most ominously*," it seems to me that the integrity of the conducting wires must have been impaired by these *strains*, particularly as the small copper wires are *straight*, and form a core for the twisted iron wire strands to pass around *spirally*, as in the ordinary rope lay. The effect of a great strain would be to "draw" out the centre wires at their weak parts, to such an attenuated thread as to retard and render "feeble" the electric current, and may not this have been the cause in this case?

The foregoing remarks may be of some service in a future attempt, for there can be no practical difficulty in laying the wire across the ocean with *medium weather*, and nothing short of a gale of wind should exon-

erate for a failure to do it successfully, as there has not been, nor will there be, any difficulty which could not be foreseen and guarded against, by a person of proper experience and judgment.

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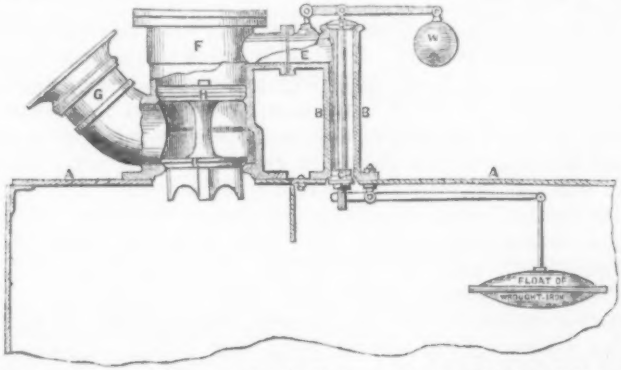
*For the Prevention of Boiler Explosions.**

The following diagram will explain the nature of the invention, for the prevention of boiler explosions, registered by Mr. Joshua Horton, an extensive boiler maker, of Brierley Hill, in this county. Mr. Horton's invention professes to effect two objects,—first, to prevent the pressure of the steam in the boiler exceeding the given pressure more than a pound or a pound and a half, on the square inch, in the case of steam generating rapidly; and secondly, in the case of the water in the boiler sinking below the proper level, to open the valve, so as to provide a sufficient outlet for the steam suddenly generated by water being pored upon the heated plates. The contrivance would, therefore, operate both as a safety valve and a buoy.

In ordinary safety valves, the weight upon the valve always remains, and the extent to which the valve is opened when the steam in the boiler exceeds the given pressure is only such as the difference between the power of the steam and the weight would occasion. In this apparatus, as soon as it comes into operation, the valve is entirely raised, and the whole aperture affords an egress for the excess of steam. The following diagram represents the contrivance, a part being shown in section. It can be fixed to any ordinary boiler, the dimensions given below being suited to a boiler 20 ft. in length and 4 ft. 9 ins. in diameter:—



A A is the upper surface of the boiler; B B is a cylinder 2 ins. in diameter, and about 14 ins. in length; at each extremity is a valve, C and D, united by a stalk, and so constructed, that when one is closed the other is open. The weight W is adjusted to the pressure at which the boiler is intended to be worked; and so long as the pressure of the steam within the boiler is less than that for which the weight is adjusted, the lower valve C will remain open, and the upper valve D will be closed. E represents a cylinder of the same dimensions as the former, at right

* From the London Mining Journal, No. 1134.

angles with and opening into it on one side, and on the other into a larger cylinder F, 6 ins. in diameter, having a bell-mouthed opening, G, communicating with the open air. H and K are valves connected together. When closed, as shown in the drawing, the upper valve H prevents the steam which passes from the boiler by the open valve C, and up the cylinder BB, through E, and to the upper part of the larger cylinder F, from escaping into the air by the mouth G. The valve D also prevents it escaping at the upper extremity of the smaller cylinder. At the same time the lower valve K, at the bottom of the larger cylinder, prevents the steam escaping from the boiler, so long as the two valves H and K are closed. They are kept closed by the steam above the valve H, passing through the valve C, counterbalancing the pressure of the steam in the boiler, which presses upon the valve K, whence this is called by the inventor an equilibrium valve. Now, let the steam in the boiler exceed the given pressure ; immediately the valve C closes, and the steam, which previously kept down the valve H, escapes at the valve D, which is now of course open. No resistance remaining above the valve H, the two valves H and K, which are connected, rise, and open a large orifice for the emission of steam by the mouth G.

The working of the float is readily explained: it is made of iron, sufficiently buoyant to float on the surface of the water, and also sufficiently heavy to close the valve C, to which it is attached, as soon as by the lowering of the water it sinks below a certain level. The large valve is then opened, and steam rapidly blows off, at once warning the engineer of the want of water, and providing an egress for steam suddenly generated by water coming in contact with the heated plates of the boiler, which is the cause of nine-tenths of the boiler explosions which take place.

The trial to which Mr. Horton's apparatus was subjected a fortnight ago proved most satisfactory. The safety valve being properly weighted, the boiler was rapidly heated. The greatest amount gained beyond the fixed pressure or "load" was one pound upon the square inch. The steam being at its height, various gentlemen got upon the boiler, and tested the apparatus so far as its capability of allowing the escape of steam was concerned. The water was subsequently allowed to escape from the boiler, and the main experiment was then commenced. The whole of the water having been drawn from the boiler, the engineer proceeded to heat the bottom plates to a red heat. This being accomplished, all present retired to a distance, awaiting the result. The engineer ensconced himself in a small hiding-place, 20 yards from the boiler, where a hand forcing pump was placed. This pump was 3 ins. in diameter, and had a 4-inch stroke. It was, in fact, such a pump as, under ordinary circumstances, would be used for a boiler of that size. The moment the cold water was injected upon the red-hot plates, a violent puff of steam issued from the bell-mouthed branch of the cylinder described. It was then evident that the danger was passed, as, had not this copious means of exit been provided, in all probability the boiler would have exploded. The equilibrium valve in this case was already open by the lowering of the float, as already described. This would not have been so with the ordinary safety

valve, from the nature of which the load is always upon it, and consequently, before there can in such a case be an escape of steam, the resistance of that load has to be overcome.

The only doubt which has been raised respecting this very ingenious contrivance is, whether the lower valve c will not be liable to be choked by impurities in the water, in which case the upper valve would not open; but experience only can decide this point. The apparatus is to be attached to a boiler in regular work, so as to have its working practically tested by careful observation.

AMERICAN PATENTS.

List of American Patents which issued from July 28th, to September 1st, 1857, (inclusive,) with Exemplifications.

JULY 28.

161. For an *Improvement in Governor for Engines, &c.;* Frederic W. Howe, Newark, New Jersey.

"This invention relates to an improvement of the fly-ball governor for regulating the motion of steam engines, water-wheels, or other metres, by means of which the motion is more perfectly regulated than by any other plan known to me."

Claim.—"The arrangement of the vertical shaft receiving motion from the motor by the differential motion to regulate the supply of steam to an engine, or water to a wheel the said shaft having arms to which are suspended the arms of the fly-balls, provided with cam-like projections, in combination with the sliding cap on the shaft, the friction cone feathered to the shaft, and fitted to a conical cavity of the column or standard, and the spring interposed between the friction cone and the cup."

162. For an *Improved Mode of Fastening Breast-pins;* Charles F. Kolb, Philadelphia, Pennsylvania.

Claim.—"The improvement."

163. For an *Improvement in Machines for Cleaning Rice;* Philip R. Lachicotte and T. B. Bowman, Charleston, South Carolina.

Claim.—"The rotating and adjustable cylinder provided with the screw or spiral flanches, and placed within the cylindrical case, in combination with the stationary wings attached to the bar on the bed; the wings being within the cylinder."

164. For an *Improved Mortising and Boring Machine;* J. M. Jay, Canton, Ohio.

Claim.—"The arrangement of the rack, adjustable brace segment slide rack, and slide table, and in combination with the parallel linked table screws, swivel nuts, and arms."

165. For an *Improvement in Mastic Roofing Compositions;* Samuel K. Lighter and James A. Morrell, Hamilton, Ohio.

Claim.—"The roofing composition, composed of the several substances in the proportions prepared and used."

166. For an *Improvement in Spark Arresters;* Ethebred May, Boston, Mass.

Claim.—"My arrangement of the spark arrester within the smoke-box of the locomotive steam boiler, so that the stack or chimney shall be prolonged down into the smoke-box, and made of wire gauze or perforated plates, and otherwise so constructed that the entire track of the smoke shall be through the gauze or perforated plates."

167. For an *Improvement in Lime Kilns;* John McGregor, Selma, Alabama.

Claim.—"The particular arrangement of the furnaces or fire chambers, in relation

to each other and to the square chamber, when the same are constructed and used in combination with the draft holes and fire flues."

168. For an *Improvement in Projectiles for Smooth Bored Guns;* John L. McConnel, Jacksonville, Illinois.

Claim.—"The improvement of the projectiles known as 'egg-shaped,' which consists in so grooving the surface, that when discharged from any smooth bored gun, with the larger end foremost, the combined effects of the centre of gravity being in front, and the grooves (acted upon by atmospheric pressure) shall give to the projectile an accuracy of flight when so fired similar to that produced by the rifle, and approximating thereto."

169. For an *Improved Spindle for Door Knobs;* Orrin Newton, Pittsburgh, Pa.

Claim.—"The arrangement of the notches on the spindle of the door knob in alternate positions on opposite corners or angles of the squared spindle, in combination with the key and the deep and shallow groove in the shank, together with the depression in the circle plate to keep the key in place, for the purpose of adjusting the length of the spindle of door knobs to different thicknesses of doors, by gradations sufficiently minute to answer all practical purposes."

170. For an *Improvement in Lime Kilns;* Clark D. Page, Rochester, New York.

Claim.—"The combination of the primary grates and the secondary grates with the plate and tubular flue, when the same are arranged to operate in relation to each other."

171. For an *Improvement in Fastenings for Carpets;* Washington H. Penrose, Philadelphia, Pennsylvania.

Claim.—"The use of bars, strips, or rods, with teeth or points either straight, inclined, or hooking, fastened to the floor on which to place the carpet, in combination with strips, bars, or rods, fastened to the wash-board to press the carpet down upon the teeth or points, for the purpose of retaining carpets upon the floor."

172. For an *Improved Bit-brace for Boring obliquely to the Stock;* Charles C. Plaisted, Chicopee, Massachusetts.

Claim.—"A bit-stock in which the socket or part that holds the bit revolves about its axis in an oblique position with reference to the stock by means of the universal joint, or its equivalent, and the adjustable connecting link extending from the socket to the stock. In combination with the above, the cylinder or coupling, by which the axes of the bit and the stock are placed and retained in line with each other."

173. For an *Improvement in the Mode of Raising Sunken Vessels;* John Ponton, City of New York.

Claim.—"The arrangement of the adjustable and changeable supports, operating alone or in connexion with the slides, whereby the tanks may be brought more closely in connexion with, and the sustaining power of them more generally and uniformly distributed along, a vessel or body."

174. For an *Arrangement of Valves and Passages to the Cylinders of Steam Engines;* John A. Reed, Jersey City, New Jersey.

Claim.—"The employment in each cylinder head for the induction, cutting-off, and eduction of steam, of two ring valves, with an arrangement of seats, ports, and passages."

175. For an *Improvement in Guard-fingers for Harvesters;* Adam R. Reese, Phillipsburg, New Jersey.

Claim.—"The combination with a cast or malleable iron guard-finger of the steel plates or cutting edges, when the same are united to the finger in the peculiar manner, and arranged to operate in relation to each other and to the cutters."

176. For an *Improvement in Treating Paper Stuff;* Julius A. Roth, Philadelphia, Pennsylvania.

Claim.—"The combined application of sulphurous acid upon woody fibres with that of the chlorine bleaching agents."

177. For an *Improvement in Machines for Drilling Rock;* Moses T. Rowlands, Pittston, Pennsylvania.

Claim.—"The combination of the vibrating centrifugal hammer with the rotating

spring, and loosely attached drill, arranged to operate in relation to each other, for the purpose of facilitating the drilling of rock."

178. For an *Improvement in Fastenings for Carpets;* Richard E. Schrœder, Rochester, New York.

Claim.—"The plate secured to a stock or directly to the flooring by a joint, the plate having a spring bearing against it."

179. For an *Improvement in Corn Planters;* Charles Schnepf, Lancaster, Penna.

Claim.—"The semi-circular shaped scooping hoes with jointed ends, in combination with the sliders, and operated by the revolving levers."

180. For an *Improvement in Boxes for Receiving Passengers' Fares;* John B. Slawson, New Orleans, Louisiana.

Claim.—"The method of preventing fraud upon proprietors of public conveyances on the part of conductors, drivers, or passengers, by means of the plate or apron, glass plates, lever, and drawer."

181. For an *Improvement in Hemp Brakes;* Stephen Stafford, Carrol Co., Missouri.

Claim.—"1st, Arranging a series of swords in a sash at unequal distances apart, and parallel to each other, the spaces between them decreasing from the upper to the lower sword of the series. 2d, Arranging a series of swords in a sash so that the edges of the under sword will project beyond the edge of the sword next above it throughout the entire series. 3d, The combination of the swords in the stationary sash, with those in the movable sash, when arranged respectively in each sash."

182. For an *Improvement in Machines for Paring and Slicing Apples;* R. W. Thickins, Brasher Iron Works, New York.

Claim.—"The two arbors attached to the rotating head, when used in connexion with the screw shaft collar with arms attached, the rack and geared segment to which the knife arm is attached. Also, the sliding tube and lever with curved arms attached, when combined with the arbors, so that by the same movement of the head, the several parts are made to work automatically."

183. For an *Improvement in Machines for Stuffing Horse Collars;* J. C. Tobias, Lincoln, Illinois.

Claim.—"Attaching the rods to a vertical bar, which is attached to the slide, and to the rack, into which the pinion, or its equivalent, is made to gear alternately, whereby the stroke of the rods or plungers may be cut off at any desirable point, and their reciprocations accommodated to the gradual filling up or stuffing of the bulge or rim of the collar."

184. For an *Improvement in Oscillating Steam Engines;* John Wallace, Pittsburgh, Pennsylvania.

Claim.—"The use of the elastic wedges in contradistinction to the unyielding devices, as an improvement thereon, when constructed, and arranged, and operating on the side pipe."

185. For an *Improvement in Revolving Fire Arms;* James Warner, Springfield, Mass.

Claim.—"The specific device in the end of the slot for preventing the retreat of the lever in the act of cocking."

186. For an *Improved Edge Plane for Trimming the Edges of Boot and Shoe Soles;* Charles Warren, Putnam, Connecticut.

Claim.—"A boot edge plane which has its cutters secured between caps and a central plate."

187. For an *Improved Shingle Machine;* Elbridge Webber, Gardiner, Maine.

Claim.—"1st, The combination of the vibrating frame with the obliquely slotted slide piece and the cam wheel. 2d, The relative adjustment of ratchet and sheave. 3d, The arrangement of the pinions with levers and dogs."

188. For an *Improved Method of Feeding the Bolt in Shingle Machines;* Wm. Wood, Westport, Connecticut.

"The object of the invention is to feed the bolt by a simple mechanism obliquely to

the knife, the ends of the bolt being moved alternately forward, so that the shingles will be cut or rived direct from the bolt in proper taper form."

Claim.—"1st, The employment or use of two screws actuated alternately from the knife frame through the medium of the lever, rod arm of the sleeve or collar, disk provided with ratchet-shaped projections, and teeth or cogs, and the plate. Further, the plate when arranged and applied to the bar, so that it may be readily disengaged from the screws when desired."

189. For an *Improved Gate Latch;* Alfred E. Morgan, Assignor to self, David Todd, and B. Waddle, Poughkeepsie, New York.

Claim.—"The arrangement and combination together within a suitable case, of a pair of vertically moving locking bolts or bars with a horizontal thumb bar."

190. For an *Improvement in Cultivators;* Harrison Ogborn, Greensfork, and George Taylor, Richmond, Indiana, Assignors to Harrison Ogborn, aforesaid.

Claim.—"The combination of the plough beams with the eccentric axles."

191. For an *Improved Sash Fastener;* F. Tarbell, Assignor to self and D. C. Bicknell, Boston, Massachusetts.

Claim.—"A sash fastener."

192. For an *Improvement in Fixtures for Curtain Rollers;* Lewis White, Assignor to self and Elisha P. White, Hartford, Connecticut.

Claim.—"The application of the friction roller."

Additional Improvements.

1. For an *Improvement in Winnowing Machines;* Joseph Keech and Stephen Stillwell, Waterloo, New York; patented June 13, 1854; additional dated July 7, 1857.

Claim.—"The arrangement of the inclined perforated diaphram within the removable blast trunk."

2. For an *Improved Hub Borer;* John Shaerer, Reading, Pennsylvania; patented Jan. 13, 1857: additional dated July 14, 1857.

Claim.—"In combination with the boring shank or shaft, the collar, with its double flanches, one above and the other below the frame, the holes, and the stop."

3. For *Improved Fire Arms;* Frederick D. Newbury, Assignor to Richard V. De Witt, Albany, New York; patented August 12, 1856; additional dated July 14, 1857.

Claim.—"The placing of the tape priming within the chamber of the arm, and operating the priming by the movement of the arm through, and in combination with, the ratchet rod and spring, and pawl spring, or their equivalents."

4. For an *Improvement in Machines for Kneading Dough;* John L. Rolland, Paris, France; patented January 9, 1855; additional dated July 21, 1857.

Claim—"So forming the kneading wings, that they shall in their revolution present alternate concave and convex surfaces to the dough, and whether these concave and convex surfaces are obtained by revolving blade or blades, in connexion with a pressing roller."

5. For an *Improvement in Packing Pistons and Stuffing Boxes for Steam Engines;* Patrick Clark, Rahway, New Jersey; patented June 2, 1857; additional dated July 28, 1857.

Claim.—"The foil packing with cloth cemented or otherwise fastened on one or both sides of it."

6. For an *Improvement in Gutta-percha Stereotype Compositions;* Leonardo Westbrook, City of New York; patented July 19, 1853; additional dated July 28, 1857.

Claim.—"The compound of gutta-percha, gums, and metallic powders combined."

Re-Issues.

1. For an *Improvement in the Method of Cutting Out the Uppers of Boots and Shoes;* John Chilcott and Robert Snell, Brooklyn, New York; patented September 13, 1853; patented in Belgium September 16, 1852; re-issued July 7, 1857.

Claim.—"Cutting or otherwise making the leather or other material to form the upper

of a boot by folding without crimping of the form, and having its characteristics, whether the said form be produced by a single piece of material or by the union of two or more pieces."

2. For an *Improved Bomb for Killing Whales;* Nathan Scholfield, Assignor to self and Wm. W. Wight, Norwich, Connecticut; patented March 10, 1857; re-issued July 7, 1857.

Claim.—"1st, Inserting the end of the fuse through a short holding pipe or collar, and securing it firmly therein by compressing the same, and driving or forcing this within the end of the fuse pipe having a conical enlargement at its rear end. 2d, Enlarging the end of the fuse cord by winding it with twine, or its equivalent, so that it cannot be drawn through the pipe, and inserting it in the fuse pipe, either with or without the fastening pipe, and putting gypsum, brimstone, or wax around it within the nut to hold it securely. 3d, The application of the sliding collar, on a projectile carrying a cylindric metallic plate covering the projectile, and either slit to form wings or unslit as a cylinder case, and so constructed that the said collar with the case or wings shall slide to the rear after being discharged from the gum, either by the action of the spring or the resistance of the air to guide its direction. 4th, So constructing and applying these wings, that they may coincide with the cylindric surface of the projectile while in the gun, and that their rear ends may be thrown up therefrom by their elasticity after being discharged, so as to stand in positions diverging from that surface in the rear. 5th, The application of helical or spiral springs on the surface of a projectile to force to the rear a collar (either with or without the guides) after leaving the gun."

3. For an *Improved Machine for Bending the Lips of Wrought Iron Railway Chairs;* The New York Wrought Iron Railroad Chair Co., City of New York, Assignees of (by mediate transfer) Samuel S. Cox, deceased; patented August 8, 1849; re-issued July 14, 1857.

Claim.—"1st, A suitable support for a chair blank, in combination with bending levers or a bending apparatus, and a former, or the equivalents thereof. 2d, A drop hammer, or its equivalent, in combination with bending levers, a former, and a suitable support for the chair blank, or their equivalents, all substantially such, and acting in combination."

DESIGNS.

1. For *Stove Ornaments;*
2. For *Stove Ornaments;*
3. For *Stove Ornaments;*

Samuel D. Vose, Albany, New York; dated July 7, 1857.

4. For *Stoves;* John C. Smith, Troy, New York, Assignor to W. Resor & Co., Cincinnati, Ohio; dated July 7, 1857.

5. For *Stoves;*
6. For *Stoves;*
7. For *Stoves;*

Samuel W. Gibbs, Assignor to Rathbone & Co., Albany, New York; dated July 7, 1857.

8. For *Grate or Stove Fronts;* John E. Bendix, City of New York, Assignor to S. B. Sexton & Co., Baltimore, Maryland; dated July 7, 1857.

9. For *Cooking Stoves;* James Maguire, Joseph A. Read, and Duncan Wright, Assignors to Charles Gilbert, Philadelphia, Pa.; dated July 14, 1857.

10. For *Stoves;* N. S. Vedder, Troy, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated July 14, 1857.

11. For *Stoves;*
12. For *Stoves;*

Samuel W. Gibbs, Assignor to Rathbone & Co., Albany, New York; dated July 14, 1857.

13. For *Parlor Stoves;* E. J. Cridge, Troy, New York; dated July 14, 1857.

14. For *Cooking Stoves;* James R. Hyde, Troy, New York; dated July 14, 1857.

15. For *Clock Cases;* Pietro Cinquinni, West Meriden, Conn.; dated July 14, 1857.

16. For *Iron Railings;* Henry Jenkins, Brooklyn, New York, Assignor to New York Wire Railing Co.; dated July 21, 1857.

17. For *Medallions of Franklin to Mark Pens and Pen Holders;* William Ball, City of New York; dated July 21, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

AUGUST 4.

1. For an *Improvement in Power Looms;* Andrew Allen, Wilmington, Delaware.

"This invention relates to the pattern mechanism for weaving fancy checks, ginghams, and other fancy goods, and consists in certain convenient means of providing for variations of the pattern, and of producing a long pattern with a short pattern chain."

Claim.—"1st, The combination of the step formed indicator, attached to the lifting and dropping mechanism of the shuttle boxes, and the adjustable pins of the pattern chain, for the purpose of controlling the pattern, and affording a greater facility for varying the same than the means heretofore used. 2d, The retarding wheel with its pins combined with the pattern chain wheel or cylinder, to arrest the pattern chain or cylinder, when several picks are required to be made by the same shuttle, or with the same filling thread. 3d, The combination of the pins on the pattern chain or cylinder, and the lever, with the pawl of the retarding wheel, for the purpose of causing the operation of the retarding wheel to be suspended under the control of the pattern chain when desired."

2. For an *Improvement in Trucks for Locomotives;* Levi Bissell, City of N. York.

Claim.—"Attaching trucks having four or more wheels to locomotive engines, so that the said truck is allowed a lateral motion under the engine, and moves upon a centre located between the drivers and the centre of the truck, in such a manner that the relative positions of the four or more truck wheels with the driving wheels, as determined by the straight or curved track, shall cause the body of the engine to assume the correct position relatively with said track. Also, the inclined planes and blocks, or their equivalents, in combination with a truck of four or more wheels having a lateral motion under the locomotive engine.

3. For an *Improvement in Nut Machines;* Robert Brayton, Buffalo, New York.

"My improvement relates to a block or trip consisting of a combination of devices by which the action or movement of the dies are so controlled in the manufacture of nuts and washers that the workman can cause the dies to descend and operate at regular or irregular intervals as the nature of the case may require."

Claim.—"The use of the trigger, spring catch, arm, pin, slide rod, provided with the spring notch, projection, and inclined plane, and in relation to, and being operated by, the foot lever and spring."

4. For an *Improved Walking-stick Gun;* Ira Buckman, Jr., City of New York.

Claim.—"1st, Moving the lock piston backward to effect the cocking of the lock, by revolving the section and its attached spiral cam. 2d, Locking the lock (for retaining the lock piston in position when moved backward to its full extent,) by the locking plate dropping into a transverse groove in the top of the piston. 3d, The construction and operation of the trigger, which enables the trigger to be closed up against the body of the gun while the lock is cocked. 4th, The combination of the locking plate with the trigger, by which the strain of the spring of the piston is brought entirely upon the locking plate, leaving the trigger free from strain or pressure, and enabling the trigger to discharge the lock with slight effort. 5th, The thimble, for the purpose of being moved over the lock catch and trigger, to confine and secure them, so that the lock cannot be operated without first moving back the thimble."

5. For an *Improvement in Vapor Burners;* D. H. Carpenter, Wallingford, Conn.

Claim.—"The bent pipe, or equivalent mingling reservoir for mixing the atmospheric air and vapor, and bringing the jet on a level with the igniting orifice, by which means the proper draft commingling and heat is attained, and the combination therewith of the check-valve, which supplies and regulates the quantity of vapor necessary to produce the maximum effect for the purposes designed."

6. For an *Improvement in Machines for Making Paper;* Patrick Clark, Rahway, New Jersey.

Claim.—"The arrangement of the conducting pipes connecting the pump with the jet pipes, for the purpose of washing the felt and cylinder with the water which has been separated from the pulp, and thus avoid the necessity of introducing for that purpose water from any other source into the machine."

7. For an *Improved Coupling of Thills to Vehicles;* S. T. J. Coleman and I. W. Sibbett, Cincinnati, Ohio.

Claim.—"Securing or adjusting the heads in the loops or hooks, by means of the boxes and bars provided with the screws."

8. For an *Improvement in Coal Stoves;* J. A. Davis, Syracuse, New York.

"This invention consists in certain improvements in the construction or arrangement of stoves more particularly designed for the consumption of bituminous coal."

Claim.—"The combined arrangement of the shallow fire-box, flues, and dampers."

9. For an *Improved Mode of Discharging Cannon;* Josiah Dodge, Dummerstown, Vermont.

Claim.—"The double spring hammer, in combination with the inclined surfaces."

10. For an *Improved Stock for Smoothing Planes;* John F. W. Erdmann, Philadelphia, Pennsylvania.

Claim.—"Placing in the throat of the plane back of the iron, the elastic strip."

11. For an *Improved Mode of Opening and Closing Window Blinds;* Lucius N. Fay and Wm. Mason, Warren, Massachusetts.

Claim.—"Operating the blind by means of the worm-wheel and flanched plate, arranged and applied to the blind and jamb post. Further, attaching the worm-wheel to the rod, which is secured to the lower part of the blind, and curved, whereby the gearing or wheel and flanched plate, or another device gearing into wheel, may be perfectly protected from the weather and dust, in consequence of the rod passing through the underside of the shell."

12. For an *Improved Device for Operating Slats of Window Blinds;* Lucius N. Fay and Wm. Mason, Warren, Massachusetts.

Claim.—"The sliding head or knob placed on the guide rod, which is attached to the cross-rail of the blind, the head or knob being connected with the slat rod by the rod, the slat rod being braced or supported by a rod attached to a rod, and the stile."

13. For an *Improvement in Steam Boilers;* Robert Ferguson, New Orleans, La.

Claim.—"The eccentric arrangement of the water spaces connected with each other, and alternating with the flues of lune cross sections."

14. For an *Improvement in Cultivator Teeth;* F. R. Forsythe, Cape Vincent, New York.

Claim.—"The new manufacture of cultivator tooth, consisting of a sheet steel blade bent to the required form, with a cast iron boss cast thereon."

15. For an *Improvement in the Let-off Motion of Power Looms;* Wm. H. Gray, Dover, New Hampshire.

Claim.—"1st, The combination of the shaft, the endless screw, and worm-wheel, or their equivalents, the friction clutch, the arms attached to the friction clutch, the lever, the cams, and the lever. 2d, The combination of the latch attached to the loose portion of the friction clutch, the levers to detain and liberate the said portion of the clutch."

16. For an *Improvement in Harvesters;* Samuel Gumaer, Chicago, Illinois.

Claim.—"The combination of the blades with the peculiarly constructed platform, and the centre swell reel, when said parts are arranged to operate in relation to each other."

17. For an *Improved File Cutting Machine;* Wm. Halliwell and Levi Osborn, Poughkeepsie, New York.

Claim.—"1st, The combined action of the two carriages, by which the machine is

enabled to remove the file that has been cut (from under the chisel), and automatically to replace it by one to be cut. 2d, The swivel head for holding the chisel, by which, in connexion with the springs, the chisel adjusts itself on the surface of the file. 3d, The levers, cams, and ratchet bar for holding the file in place."

18. For an *Improvement in Bobbins for Roving and Stubbing;* Isaac Hayden, Lawrence, Massachusetts.

Claim.—"Making that portion of the barrel of the bobbin which receives and takes up the second layer of roving, larger than that part of the barrel which receives and takes up the first layer, to compensate for the thickness of the said first layer, and makes the draft on the roving or stubbing uniform."

19. For an *Improvement in Sewing Machines;* Abial C. Herron, Remson, N. York.

Claim.—"The hook and roll, arranged and operating in combination with the needle."

20. For an *Improvement in Fictitious Ivory;* Dr. Ludwig Held, Brooklyn, N. York.

Claim.—"The ivory-like plastic compound, produced principally by a combination of cartilaginous substance or vegetable fibre, with vasic chloride of zinc, and gum resins."

21. For an *Improvement in Cutting Screws;* Peter Hoffner, Rising Sun, Indiana.

Claim.—"In combination with the die stock, the volute or spiral spring."

22. For an *Improvement in Sugar Boilers;* Peter Holbrook, Whitingham, Vermont.

Claim.—"The steam pan, in combination with the sap pan, and the cover to the syrup pan, and the stop-cocks to the steam pan and sap pan, or their equivalents."

23. For an *Improved Device for Protecting the Necks of Horses from Flies;* Ernst L. Kurtz, City of New York.

Claim.—"The stretchers, in combination with the connecting cords, as a fly protection. Also, the weighted cords connected therewith for keeping the protector stretched, and at the same time permitting the free movement of the animal's head."

24. For an *Improved Projectile for Rifled Cannon;* Theodore T. S. Laidley, of the U. S. Army.

Claim.—"The attachment to the main body of an elongated projectile, either solid or hollow, of a covering of some malleable material composed of one or more pieces, embracing the whole or a portion of the exterior surface by imbedding in the cast metal of the shot, the turned-in end, and two or more longitudinal seams or edges, so as to form on the cylindrical surface of the projectile, two or more pockets, having a free space between the cast metal of the shot and the malleable covering, into which the gases at the moment of discharge entering, will force out the covering, and cause it to fill the grooves of the rifled gun, and diminish or entirely cut off the windage of the projectile, whether fired from a rifled or smooth bored cannon."

25. For an *Improved Stop-cock Gas Regulator;* O. L. Lawson and A. A. Starr, City of New York.

Claim.—"The cock with conical plug on which is cone-shaped groove extending entirely around the same, in combination with the mechanical devices, for the purpose of a portable gas apparatus for vessels, cars, &c."

26. For an *Improved Window Blind Slat Holder;* William S. Mayo, City of New York.

Claim.—"The construction and application to the rods of window blinds, of springs or friction pieces of metal to hold the slats in any given position."

27. For an *Improved Device for Operating Window Blinds;* James McMackin, City of New York.

Claim.—"The car, constructed of three pieces provided with the fastening formed of the slotted plate on the piece, and the ledge on the piece, the bar being applied to the blind, and fitted within the sill."

28. For an *Improved Key;* Stuart Perry, Newport, New York.

Claim.—"A bank or store lock key, in which the bits have a movement before, during, and after they have arranged the slides or tumblers of the lock which it is to ope-

rate upon, so that all trace of the exact point or part of the movement of said key-bits, at which such arranging of the slides or tumblers takes place, shall be destroyed, and thus prevent any one but the maker of the lock from making a duplicate."

29. For an *Improvement in Compound Capstans for Ships;* Charles Perley, City of New York.

Claim.—"The combination of the adjustable bearing block with the heaver or windlass, so constructed as to receive the strain and weight of chain cable, and relieve the shaft therefrom, leaving said shaft when disconnected from said heaver or windlass free to rotate and be used for other purposes, without loss of power by the friction of said heaver or windlass, even when the vessel is riding at anchor by said heaver. Also, the power capstan and its coupling fitted to slide endways of the shaft, combined with the heaver or windlass and bearing block, whereby the said power capstan connects the shaft and heaver, or is itself free for use as a power capstan or bit, when connected to, or disconnected from, said heaver or windlass."

30. For an *Improved Machine for Forging Nails;* Samuel J. Seely, City of N. York, Assignor to John M. Hood, Brooklyn, New York.

Claim.—"The employment of two anvil faces placed at an angle with each other, and having a rocking motion to bring them alternately in contact with the article to be forged, in combination with hammers."

31. For an *Improvement in Harvesters;* N. C. Sherman and S. Lightcap, Hazle Green, Wisconsin.

Claim.—"The combination of the peculiar formed adjustable collar with the castor frame, whereby the castor wheel may be at the pleasure of the driver, held rigid in line parallel with the driving wheels, or released so as to turn in the ordinary manner."

32. For an *Improved Propeller Blade;* George W. Swartz, Buffalo, New York.

Claim.—"A propeller blade."

33. For an *Improved Self-feeding Drill;* George C. Taft, Worcester, Massachusetts.

Claim.—"Connecting the screw with the crank by means of the clamp."

34. For an *Improvement in Harvesters;* Charles Tinker and J. A. Sprague, Mantua, Ohio.

Claim.—"The vibrating arm, parallel rod, and connecting rod, in combination with the bent levers, fulcrum wheels, levers, and stops, when the same are arranged to operate in relation to each other (and used in connexion with a self-adjusting cutter and finger bar)."

35. For an *Improved Machine for Beveling Staves, &c.;* John Trahine and Charles Vœbel, New Orleans, Louisiana.

Claim.—"Merely the specific arrangement."

36. For an *Improvement in Boot Trees;* Wm. Upfield, Lancaster, Ohio.

"My aim in this invention is the construction of boot trees whereby the process of lasting may be perfectly and conveniently applied to every part of the boot, and in such a manner as to produce a uniform tension of leather throughout."

Claim.—"1st, The grooves cut in wedges, the side pieces with inclined planes. 2d, Also, the wedge, in combination with post and wedges, or their equivalents. 3d, Also, the nut, the right and left screw shaft, wedges, or their equivalents. 4th, Also, in this connexion, a sleeve, in combination with block."

37. For an *Improvement in Shower Bath Apparatus;* Noah Warlick, La Fayette, Alabama.

Claim.—"The combination of the double armed bolt with the valves, whereby it is made to perform the double function of securing the valve to its seat, and also of operating said valve."

38. For an *Improvement in Fictitious Ivory;* William M. Welling, City of New York.

Claim.—"Forming artificial ivory by thoroughly mixing and combining the articles having equivalent properties while under the operation of heat."

39. For an *Improvement in Elastic Gore Cloth;* Charles Winslow, Lynn, Mass.

Claim.—"An elastic band or gore cloth when made not only of a fabric composed of cement of india rubber or gutta percha, and two pieces of cloth in which the warp and

weft of each piece are made to cross one another diagonally or at an acute angle, but with the edges of the cloth cut and over lapping in lines parallel or approximately so to the weft, and at acute angles with the warp threads, and cemented down to the fabric."

40. For an *Improved Machine for Grinding Knives;* Anthony Hankey and Francis Stiles, Jr., Assignors to selves and Frederick S. Taylor, Leicester, Massachusetts.

Claim.—"Giving to the knife or other article to be ground or polished, a vibratory motion in a plane tangent to the plane of motion of the stone or wheel, or parallel therewith."

41. For an *Improvement in Pedestal for Railroad Cars;* Daniel H. Feger, Assignor to self and Daniel Shepherd, City of New York.

Claim.—"The employment of a loose or movable jaw to the pedestal."

42. For an *Improved Joiners' Plane;* Thomas D. Worrall, Lowell, Mass.

Claim.—"1st, The employment of the clamp lever for securing and bedding the bit. 2d, The clamp lever, as arranged in combination with T strap and nut, for the purpose of regulating and adjusting the bit for cutting, when firmly bedded and secured."

43. For an *Improvement in Cleaning and Carding Moss;* Louis Boudreaux, Thibodeaux, Louisiana.

Claim.—"The combination of the vibrating bed with the bed and the teeth, arranged with relation to the cylinder and roller."

44. For an *Improvement in Tawing and Coloring Skins and Furs;* Harmon Hibbard, Henrietta, New York.

Claim.—"The process of compounding either of the alkalies with the materials, and the process of applying those compounds, or either of them, to pelts, fur, wool, or hair for tawing or coloring."

AUGUST 11.

45. For an *Improvement in Mowing Machines;* William Bacheller, West Newbury, Massachusetts.

Claim.—"The combination of the thill frame with the cutter frame, when said frames are constructed and used in combination with the supporting wheels and operating wheels."

46. For an *Improvement in Automatic Lubricator for Railroad Car Axles;* Wm. Baker, Utica, New York.

"The nature and object of this invention is to convey the oil, or other lubricating material, from the fountain or reservoir below to the journal, simply by means of the agitation within the box caused by the violence of concussion on the rail, without any dependence on the revolving of the journal or other mechanical agency."

Claim.—"The mode of conveying and applying the lubricating material to the journals of railroad cars and locomotives, by ejecting the same from the reservoir to the journal by the use of the piston, which is moved directly by the jar or concussion when the car or locomotive is in motion, without the aid of capillary attraction, or the use of any absorbent whatever, or of any mechanical agency to be propelled by the revolving action of the journal."

47. For an *Improved Rotary Veneer Machine;* Gilbert Bishop, City of New York.

"This invention consists in cutting veneers and other thin stuff by a knife, with a circular or curved edge in rotation in the line of its edge, while the log from which the veneer is to be cut is vibrated or turnerd towards the knife edge as it passes, so that the knife progressively covers the whole top surface of the log, and cuts the veneer by a continuous rotary drawing, thrusting, and varying stroke of the edge from point to heel, as the log is presented to and brought in contact with it."

Claim.—"1st, The revolving disk and knife placed eccentrically to the disk upon the under surface or upon the edge of the disk, and having a curved edge for cutting the log in the line or direction of the edge of the knife. 2d, The vibrating of the log by means of the log box, arms, cams, and toes, connected with the rotation of the shaft of the disk, so as to present the whole top surface of the log to the edge of the knife

as it passes, and by a continuously varying line of cut or stroke. 3d, The manner of constructing the log box with the movable bottom composed of the call and clamp pieces for holding, shifting, and adjusting the boxes. 4th, The combination of the log box and feed apparatus."

48. For an *Improved Dredging Machine;* Asa Blood, Senr., Norfolk, Virginia.

Claim.—"1st, The dog, in combination with the beam and rod, for the purpose of holding the dredge open in descending, and for relieving its hold by its own weight as soon as the weight is taken off the chain or rope. 2d, The combination of the levers with beam and rod operating for the purpose of opening and closing the dredge."

49. For an *Improvement in Glass Ware Holders;* Hiram Dillaway, Sandwich, Mass.

Claim.—"An instrument composed of a handle, a supporting plate, a yoke, and a spring, combined, whether the yoke be provided or not with an internal holding die."

50. For an *Improvement in Machines for Hulling Cotton Seed;* William R. Fee, Cincinnati, Ohio.

"My invention consists of cutting edges with deep intervening furrows for hulling cotton seed, by a clear cut instead of a grinding or crushing action."

Claim.—"A series of cutting edges with deep intervening furrows, for the purpose of hulling cotton seed by a cutting action, which renders both the screening process and the expression of the oil easy and complete."

51. For an *Improvement in Water Closets;* Lewis Fisher, Buffalo, New York.

Claim.—"The arrangement of the sliding cover with the jointed seat and springs."

52. For an *Improved Arrangement of Feed Rollers for Planing Machines;* Benaiah Fitts, Worcester, Massachusetts.

Claim.—"The internal gear, and the external gear, in combination with the pinion and connecting arms."

53. For an *Improvement in Mowing Machines;* Alanson Gale, Poughkeepsie, New York.

Claim.—"Operating the cutter bar from the master wheel by means of the mechanism, constructed and arranged in relation to the main frame and master wheel of the machine."

54. For an *Improved Machine for Whetting Plane Bits;* Jesse M. Gilstrap, Washington Co., Arkansas.

Claim.—"The use of the bit holder."

55. For an *Improvement in Hominy Mills;* J. B. Gowdy and J. A. Welsh, Xenia, Ohio.

Claim.—"The shaft provided with the beaters and flanches, in combination with the horizontal plate within the perforated case."

56. For an *Improvement in Curtain Fixtures;* Nathaniel S. Graves, Boston, Mass.

Claim.—"When the sides of the groove are dove-tailed, whereby the curtain is securely held to its roller without other fastenings."

57. For an *Improvement in Brewer's Steam Boiling Apparatus;* Adolph Hammer, Reading, Pennsylvania.

Claim.—"Arranging the steam pipe in boiling apparatus in two or more separate and distinct parts or series, whereby either, both, or all parts or series of pipes may be elevated by rotating the same upon axes of rotation at or near the centre of the tub."

58. For an *Improvement in Ships' Capstans;* Samuel Huse, City of New York.

Claim.—"The arrangement and use of the hollow shaft attached at one end to the drum or head, and in combination therewith the movable gear plate, and worked by a pinion on the lower end. Also, in combination with such hollow shaft and movable gear plate, the arrangement of the clutch levers, or an equivalent thereof, for the purpose of connecting such movable gear plate to the barrel, and at the same time disconnecting the head and barrel, or vice versa, and thus changing the action of the capstan to a quicker or more powerful one in a moment, and without changing its motion or displacing any gear."

59. For an *Improved Steering Apparatus of Steam Carriages;* Edward C. Jones, Pittsburgh, Pennsylvania.

Claim.—"1st, Operating the clutches of the driving wheels by the same parts by which the steering wheel is operated in such a manner as to disengage (by operating the said clutches,) the one or the other of the driving wheels simultaneously with the turning of the steering wheel to the right or left. 2d, The arrangement of the lever, links, levers, with their arms connected therewith, by a but hinge joint and the springs, when constructed, combined, and operating in connexion with the pinion, and the clutches. 3d, The arrangement of a pivot in or near the centre of the steering wheel, and passing through its axle."

60. For an *Improvement in Ships' Capstans;* David Knoulton, Camden, Maine.

Claim.—"The combination of the gear at the bottom of the capstan (when made and applied so as to be rotated or be made fast alternately) with the gear or pinion attached to, and revolving with, the capstan head, they being connected by gears."

61. For an *Improvement in Automatic Lubricator for Railroad Car Axles;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The arrangement of the lever rod and spring, combined with the car or their equivalents, for actuating the lubricator by the vertical vibrating motion of the cars."

62. For an *Improved Valvular Arrangement in Faucets, etc.;* John C. Macdonald, Cincinnati, Ohio.

Claim.—"The arrangement of the valve stem, the nut, the valve guide, the screw and the cap or screw, and nut guide, which also contains the stuffing-box."

63. For an *Improvement in Silk Dyeing Machines;* Nicholas Mary, Sen., Philadelphia, Pennsylvania.

Claim.—"The combination of the steam chambers with the friction surface rollers, for preparing and dyeing the material."

64. For an *Improvement in Instruments for Indicating the Depth of Water in Ships;* G. B. Massey, Mobile, Alabama.

Claim.—"The arrangement of the parts relatively to one another for united operation to produce a leakage alarm and register for ships, to wit, the bell arranged on a firm part of the vessel, the spring within the barrel, and the barrel within the belt; the float chain on the spring barrel, the hammers within the belt, the pin wheel, and the mechanism by which they are operated and controlled on the arbor of the spring barrel, and the mechanism which measures the rise and fall of water alongside the signal mechanism, and so as to be actuated by the spring which sounds the alarm."

65. For an *Improvement in the Manufacture of Sulphuric Acid;* Alfred Monnier, Camden, New Jersey.

Claim.—"The process of preparing native metallic sulphurets, by pulverizing them and mixing them with the substances described, in order to extract all or nearly all the sulphur from them for the purpose of making sulphuric acid."

66. For an *Improvement in Reefing Top-sails;* James W. Norcross, Boston, Mass.

Claim.—"My arrangement of reef tackles, the same consisting in fastening the said reef tackles to the sail at or near the reef band, thence leading them upward through sheaves or blocks, or their equivalents, applied to the top-sail yard, and from thence extending the said reef bands upward and through blocks suspended to the cross-trees or that part of the top-mast just below them, and thence leading the reef tackles downward and fastening them to the top-sail yard at or near its middle."

67. For an *Improvement in Filtration Press for Expressing Liquids from Substances;* William Needham and James Kite, Vauxhall, England.

Claim.—"The exclusive use of the combination of parts, forming apparatus or machinery for expressing liquids or moisture from substances."

68. For an *Improvement in Bathing Apparatus;* John K. O'Neill, Kingston, New York.

Claim.—"The combination of the annular pipe, or its equivalent, with the flexible connecting pipe, or its equivalent."

69. For an *Improvement in Sausage Cutters;* Jacob Peters, Hummelstown, Pa.

Claim.—"Only the arrangement of two sets of knives working into each other with motions in opposite directions."

70. For an *Improvement in Gas Generators;* Allan Pollock, Washington, D. C.

Claim.—"1st, The peculiar form and arrangement of the retort with the grooves, for the passage of the gas from the vent holes of the canister to the gas chamber. 2d, The canister with the vent holes, by which I take the gas from the centre of the canister, the lid extending down to or near the top of said vent holes."

71. For an *Improvement in Safety Tops for Railway Cars;* Albert Potts, Philadelphia, Pennsylvania.

Claim.—"1st, The mode or manner of constructing railway passenger cars, with the tops and bodies disconnected. 2d, The metallic plates or grooved and beveled rails for uniting the tops with the body of the car. 3d, The combination of the pendulums for the purpose of holding the tops to the bodies of the cars."

72. For an *Improvement in Mechanism for Operating Railroad Car Brakes;* E. R. Roe, Bloomington, Illinois.

Claim.—"The combination of the 'anchor' in its connexion with the arm and the pin, and operated by the cams and pins, in connexion with the wheel."

73. For an *Improvement in Mash Cooling Machines;* Jesse Shilling, Troy, New York.

Claim.—"The hollow arms, with the hollow teeth attached, said teeth, some or all, having lateral shares or projections attached, the hollow arms being attached to a rotating shaft, and communicating with a pipe which is connected with a fan-box."

74. For an *Improvement in Dress of Grinding Surfaces for Grain Mills;* Otis W. Stanford, Cincinnati, Ohio.

Claim.—"The alternated channels and grinding surfaces, as represented, on the surfaces of the plate, when said alternate channels and grinding surfaces are made concentric with the centre of motion given to the plate."

75. For an *Improvement in Lime-Kilns;* Daniel Stephens, Elmira, New York.

Claim.—"The diagonal or oblique flues with sloping bottoms, in combination with the shaft and its branches."

76. For an *Improved Filter;* John A. Thompson, Cayuga, New York.

"The improvements consist in the direction of the water from the side of the vessels used in the operation, and the more perfect passage of the same through the filtering material, the retaining of all the sediment and impurities in the first vessel, and ready removal of the same."

Claim.—"The combination of the receiving vessel or upper filter, the reservoir with the flanch or rim, and attachable air and draft pipes to same, not confining myself to any particular mode or material which shall produce like effects and results."

77. For an *Improvement in Steam Gauges;* D. G. Wells, City of New York.

Claim.—"The use of a flattened tube when constructed and arranged in layers."

78. For an *Improved Tea Kettle;* Wm. Westlake, Milwaukie, Wisconsin.

Claim.—"A tea kettle."

79. For an *Improved Finger Bar for Reaping and Mowing Machines;* John T. Whitaker and Calvin D. Read, St. Charles, Illinois.

"Our invention consists in the use of a rolled tubular finger bar of peculiar form and construction, whereby the efficiency and strength of the machine is greatly increased, and its weight materially lessened."

Claim.—"A tubular finger bar."

80. For an *Improvement in Adjustments for Try-squares;* Joel Whitney, Winchester, Massachusetts.

Claim.—"The flattened pin working in the slot, in combination with the eccentric pin."

81. For an *Improved Machine for Smoothing Planed Wooden Surfaces;* Baxter D. Whitney, Winchendon, Massachusetts.

Claim.—"The scraper, in combination with a mechanism for the purpose of carrying the wood forward in contact with the scraper."

82. For an *Improvement in Machines for Polishing Stone and Glass;* George H. Wood, Green Bay, Wisconsin.

"My invention consists in the peculiar means employed for polishing stone, glass, and other materials in an expeditious and perfect manner."

Claim.—"The polisher, in combination with the adjustable guide and gauge frame, and the reciprocating carriage, when the whole is arranged to operate conjointly."

83. For an *Improvement in Spring Lancets;* Jefferson T. Martin, Administrator of Wm. Parkinson, dec'd., Marshall Co., Virginia.

Claim.—"The application and adjustment of the spring, being the re-action spring, by which the blade is instantly drawn back."

84. For an *Improved Press for Shearing and Punching;* Benjamin F. Hooper, Assignor to self and Ransom Ballou, Jr., Albany, New York.

Claim.—"The employment of the beam having an inclined slot in its extremities carrying the pins on which the punch and shears are suspended."

85. For an *Improvement in Machines for Marking Time of Attendance of Workmen;* Benjamin T. Harris, Assignor to John McKillop, Brooklyn, New York.

Claim.—"1st, The combination of the registering surface, operated by clock-work, with the movable markers. 2d, The combination of the movable markers and their arms, with the indicators and their concomitant parts."

86. For an *Improvement in Machines for Moulding Bricks;* I. Z. A. Wagner, Philadelphia, Pa., Assignor to P. H. Watson, Washington, D. C., Assignor to E. S. Renwick, City of New York.

Claim.—"The combination of the mould-box with a core, and an annular bottom or piston."

87. For an *Improvement in Sewing Machines;* Wm. C. Watson, Assignor to self, G. H. Wooster and J. W. Gregory, City of New York.

Claim.—"The improved device for seizing the loop, and holding and presenting it for the passage of the needle, consisting of a vibrating hook, in combination with a gripper or hold-fast, so arranged and operated as alternately to close upon the loop after being engaged by the hook to draw back the said loop, and to release the same after the passage of the needle through."

88. For an *Improved Machine for Turning Spools;* Augustine D. Waymoth, Assignor to self and H. W. Page, Fitchburg, Massachusetts.

Claim.—"The combination of a stamping or milling wheel with mechanism for turning a spool from a piece of wood, the said wheel being arranged so as to mill, engrave, or indent the end of a spool while said spool is being made, or before it is separated from the stick. Also, the combination of the two pitmans and the lever plate or wheel, or equivalent devices, with a lever for elevating the severing cutter, and that for carrying the body cutter, whereby the said body and severing cutters are made to operate, that is, during one single forward movement of the lever connected with the severing cutter. Also, the tapering screw-chuck."

89. For an *Improvement in Hot Air Furnaces;* Daniel P. Weeks, Boston, Assignor to self and Eben Seavey, Charlestown, Mass.

Claim.—"The combination and arrangement of the parachute radiator, air chamber, and pipes with the fire chambers, and the reverberating chamber, having smoke passages or pipes applied to the same, and leading into the radiator. Also, the manner of constructing the radiator, viz: with a tapering tunnel, an annular deflecting dome, and a discharge passage or pipe. Also, constructing the air chamber with a bulb or projecting part, when such chamber is arranged within a reverberating chamber made to communicate with the discharge pipes, and a chamber of combustion, and to surround the radiator opening at its lower end into the said chamber of combustion."

90. For an *Improvement in Winnowing Mills;* Manasseh Grover, Clyde, Ohio, Assignor to self and H. Seely, Hudson, Michigan.

Claim.—"Arranging in the throat or opening of the fan case, a series of troughs or scoops, in combination with the obtuse angles of the fan blades."

91. For an *Improvement in Machines for Pegging Boots and Shoes;* Benjamin F. Sturtevant, Assignor to self and Elmer Townsend, Boston, Mass.

Claim.—"The bell-shaped feed wheel and its arrangement with reference to the awl and peg wood carrier, and provided with one or more ranges of holes, the awl being made to work at an inclination to the axis of the feed wheel, or from the axis towards and through the rim of the wheel. Also, the mode of feeding the shoe along, that is, by the awl, or its equivalent, and the feeder wheel, the latter not only assisting in feeding the shoe along by the pressure and action of the ranges of tapering holes, but in holding the shoe in position while the awl is raised out of the sole."

92. For an *Improved Expanding Auger Bit;* Asa Weeks, Assignor to self and Orrin W. Fiske, South Boston, Massachusetts."

Claim.—"Combining with the double threaded screw and arranging on the split tapering shank, a rotary sleeve and its screws."

93. For an *Improved Drop Press;* Wm. Wilson, Jr., Assignor to Wilson, Green, & Wilson, Jr., Brandywine, Delaware.

Claim.—"The employment of the spring when so arranged with the drop, as to effect the delivery of the article stamped."

94. For an *Improvement in Setting Porcelain Teeth;* Martin Luther Wright, Cleveland, Ohio.

Claim.—"The making of parts of full sets or parts of half sets of teeth for either the upper or under jaw, where one or more teeth are good and permanent, and where one, two, or more may be skipped, making the whole plate and teeth of one piece of porcelain."

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95. For an *Improvement in Tubular Shafting for Mills, &c.;* Zachariah Allen, Providence, Rhode Island.

Claim.—"The improved hollow shafting, forming a continuous line of mill shaft and pulley or belt drum."

96. For *Improved Rotary Planing Cutters;* H. H. Baker, New Market, N. Jersey.

Claim.—"The recess in the face of the cutter wheel."

97. For an *Improvement in Gas Regulators;* John H. Cooper, Philadelphia, Pa.

"My invention has for its aim the production of a gas regulator, the flow of gas through which shall be direct, and which shall afford a ready means of disposing of the water which accumulates from the distributing pipe. It has for its further object the balancing of the pressure on the cut with the least amount of friction possible."

Claim.—"The double rimmed inverted cup with an inclined surface; said cup having a valve and an opening formed by the rim, when the said opening and valve are concentric with the inlet formed by the inner flanches of the casing."

98. For an *Improved Raking Apparatus for Harvesters;* Israel Dodenhoff, Bloomington, Illinois.

Claim.—"The rake, in combination with the platform and stationary and elastic guides. Also, the gate, in combination with a rake, traveling in a horizontal endless track."

99. For an *Improvement in Grate Bars of Furnaces;* Edward Dugdale, Burlington, New Jersey.

Claim.—"The flexible grate bars, when used in connexion with a raising and lowering or shaking apparatus, so as to change the position of the fire, prevent the baking of the coal, and sift out the ashes, cinder, &c."

100. For an *Improved Machine for Bending Metal Plates;* E. L. Gaylord, Terrysville, Connecticut.

Claim.—"The combination of the reciprocating bed, forming or bending die, and rollers, arranged so as to operate conjointly."

101. For an *Improvement in Cooking Stoves;* Sidney Godley, Lockport, New York.

Claim.—"1st, The arrangement of the stove with the movable adjusting plate, which is one of the entire sides of the stove, and detaching it for a cover to the baker, when the same is used with stove, the whole when arranged forming a complete cook and baker. 2d, The adjustable extension chamber to be attached to a stove, when it is desired to extend its cooking and heating capacity, the stove being a complete stove with or without the attachment."

102. For an *Improvement in Hoops for Ladies' Skirts;* Charles S. Goodman, Washington, D. C.

Claim.—"Constructing the hoop of spools or tubes as strung upon an elastic cord, or its equivalent, to give elasticity to the hoop, with the ends of the spools cut on a line radiating to the centre of the hoop, whether the same be made of wood or any other substance to produce the same effect."

103. For an *Improvement in Manufacturing Metal Buttons;* Jared O. M. Ingersoll, Ithaca, New York.

Claim.—"The manner of securing the points to and through the button by passing said points, when bent, through openings in the collet of such buttons, and fastening said points and collet securely in place by pressure."

104. For an *Improvement in Eye Shading Apparatus;* Francis H. Jones, Federalsburg, Maryland.

Claim.—"The arrangement in the top of the tube of the ventilator and light graduating contrivance, when the tube is designed for use."

105. For an *Improvement in Percussion Powder;* Magnus Kling, Reading, Penna.

Claim.—"The combination of antimony with chlorate of potassa, oxalic acid, and glue, mixed in the proportions for a composition for the manufacture of percussion caps for fire arms."

106. For an *Improved Machine for Dressing Saws;* Philo Maltby, Dayton, Ohio.

Claim.—"The devices, or their equivalents, for clamping and holding the plate of the saw, in combination with the devices, or their equivalents, for holding, operating, and feeding the tool to plane the teeth of the saw. And in combination with the devices, or their equivalents, for holding the plate and planing the teeth of the saw, the apparatus, or its equivalent, for operating and feeding the drill by power or motion derived or communicated from the planing apparatus, so as to drill the holes in the plate at the same time the teeth are planed."

107. For an *Improvement in Railroad Car Brake;* James Mitchell, Osceola, Iowa.

"This invention consists in a peculiar combination of devices for causing the descent of brake shoes upon the rails and in front of the car wheels on the departure of the forward car from the track."

Claim.—"The combination of the lever, detent, hooked rod, adjustable collar, standard, rod, slotted table, and bent lever, when said parts are arranged for joint operation with each other and with the shoe suspending apparatus."

108. For an *Improved Machine for Bending Metal Plates;* Julius Perry, Plymouth Hollow, Connecticut.

"The object of this invention is to roll into sharp angular form at one operation, the edges of bent metal plates, so that the plates will not require to be manually operated upon, or at least not materially, after being drawn through the machine."

Claim.—"The two rollers and bed placed in positions relatively with each other. Further, the rollers and bed, in combination with the die or draw plate."

109. For an *Improvement in Inhaling Apparatus;* John C. Schooley, Cincinnati, Ohio.

Claim.—"The so combining the ice receptacle with the openings, and so arranged that the outside atmosphere after being cooled and dried by passing over ice, or its equivalent, within said receptacle, can be inhaled into the lungs."

110. For an *Improvement in the Construction of Artificial Hands;* Wm. Selpho, City of New York.

"This invention consists in the manner of constructing the joint on which the fingers move, and connecting the spring and parts that move the said fingers; also, in the manner of opening the fingers by a motion derived from the shoulder of the opposite arm."

Claim.—"Constructing the skeleton fingers on the metallic cross pipe set in eyes in the line of the knuckle of the hand, and provided with the contractible spring, acting on one side of said pipe to close the hand. Also, opening the artificial hand on one arm by a motion derived from the shoulder of the other arm of the wearer, said motion acting through the shoulder loop, strap, and cord, or their equivalents."

111. For an *Improvement in Telegraphic Repeaters;* John E. Smith, Troy, New York.

Claim.—"The connexion of a battery at each station with the line wire, and with two local cross connexions, in such manner that by means of the key and relay lever, the cross connexion through the register magnet, and the other cross connexion, are alternately broken, and the battery thrown upon the main line, and its current caused to operate the relays on the line wire, like a main current, till shut from the line by the relay lever, whereby each battery is made to perform the duty of an ordinary local battery while not wanted on the line wire, and to perform the duty of the main battery while not wanted as a local. Also, the key placed on the local circuit and constructed to open and close the said circuit in two branches to give two directions to the current over the line wire."

112. For an *Improvement in Railroad Rail;* Edward W. Stephens and Richard Jenkins, Covington, Kentucky.

"Our improvement consists in forming a '⊤ rail,' with an aperture extending lengthwise through the thick upper portion of the rail."

Claim.—"The tubular ⊤ railroad rail: that is to say, having the two portions of its web welded together at the neck, and branching to the outer and inner edges respectively of the tread or track of the rail."

113. For an *Improvement in Bakers for Cooking Stoves;* P. P. Stewart, Troy, New York.

Claim.—"The employment of the plate or pan with its legs to rest on a stove plate, its projecting wires at the angles to guide the reflector, and its aperture or slot in the middle of the length, in combination with the tin reflector enclosing the whole, and leaving a space all around, which together with the slot in the middle of the plate or pan will permit the heat radiated from the stove plate to be reflected on the top of the articles to be baked or roasted."

114. For an *Improved Shears for Cutting Metal;* Timothy F. Taft, Worcester, Mass.

Claim.—"The rolling lever upon an inclined plane, which is upon the side or blade holder."

115. For an *Improvement in Hot Air Registers;* Joseph V. Tibbetts, City of New York.

Claim.—"The valves placed in the ascending pipe at or near the centre with independent movements."

116. For an *Improved Machine for Twisting Curb Chains;* Lauriston Towne, Providence, Rhode Island.

Claim.—"The combination of the vibrating spiral die and stationary holding die plates, or their equivalents."

117. For an *Improvement in Portable Horse Powers;* Daniel Woodbury, Rochester, New York.

Claim.—"Poising the frame of said horse power upon a pair of journals or spindles, which are received into the hubs of suitable transporting wheels, when the said frame is combined with the jointed bars and the jointed frame."

118. For an *Improvement in Tanning Liquids;* Leo de La Peyrouse, Paris, France, Assignor to Michael J. A. Guiet, City of New York.

Claim.—"Combining with the tanning solution or liquor the chloride of tin or its equivalent, in which the skins are handled."

119. For an *Improvement in Self-acting Mules for Spinning;* George Wright, Grafton, Massachusetts.

Claim.—"1st, Giving a second draft to the yarn after the delivery of the ends has ceased. 2d, Operating certain motions upon the carriage, such as braking up the spindles, backing off the yarns, and operating the upper faller by the taking-in scroll chain. 3d, Running the drum band over a vibrating arm upon the carriage, and clamping it thereto at intervals for the purpose of backing-off and winding up the yarn. 4th, Hanging the stop which holds the carriage stationary while the second twist is put into a spring, so that it may yield in the manner to prevent injury or breakage of the yarn. 5th, Varying the obtuseness of the cone upon different portions of the cop by means of the block."

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120. For an *Improved Filter;* Wm. W. Ayres, Worcester, Massachusetts.

Claim.—"The combination of cylinders with the spindle, when constructed with reception and discharge cavities, openings, and channels."

121. For an *Improved Machine for Wetting and Cutting Paper for Printing Presses;* Moses S. Beach, Brooklyn, New York.

"The object of this invention is to take paper from an endless sheet or reel, wet or moisten it suitably for purposes of printing, cut it off in sheets of any desired size, and deliver them to the impression cylinder of the printing press, without the intervention of hand labor. It may be applied, however, to other purposes, where moistening and cutting into sheets are desirable."

Claim.—"1st, Simultaneously cutting or moistening both sides of the paper. 2d, Leaving the paper dry at the point or line of cutting. 3d, Catching the knife when retired within the circumference of the cylinder, retaining it while so retired, and releasing it from the operation of cutting by means of the catches, the springs, and the tripping pins. 4th, Combining the cutting apparatus with the wetting cylinders or rolls."

122. For a *Combination of Watch Keys with Finger Rings;* Elihu Bliss, Newark, New Jersey.

Claim—"A watch key and finger ring combined."

123. For an *Improvement in Machinery for Manufacturing Hat Bodies;* Joseph Booth, Newark, New Jersey.

Claim.—"The rotating flat hurdle, having its perforated surface divided, in combination with a picking or blowing apparatus, and air exhausting apparatus. Also, the arrangement of the fan shaft upon the spindle of the revolving hurdle."

124. For an *Improved Method of Hermetically Sealing Cans;* Wm. Borrman, Cincinnati, Ohio.

Claim.—"The mode of hermetically sealing cans by means of the central screw stem and sheath, in the combination with the pliable lid, nut, and gaskets."

125. For an *Improvement in Umbrellas and Parasols;* Sheldon Canfield, Derby, Connecticut.

Claim.—"The form and construction of the clasp, it being made of a single piece of thin sheet metal, so folded in the middle, either by a machine or otherwise, as to form on the under side of the clasp two flanches, each consisting of a double thickness of sheet metal. Also, the clasp as applied to umbrellas and parasols."

126. For an *Improved Device for Piercing Blind Slats to receive the Staples;* John Carpenter, Stonington, Connecticut.

"My invention consists of a peculiar arrangement of machinery for cutting the tenons on both ends of blind slats, and piercing them for the wire staples simultaneously."

Claim.—"The application of the piercing points to the sliding dog, so that the slat may be pierced for the wire staples by the same action as that by which they are held secure for forming tenons thereon."

127. For an *Improvement in Separating Ore;* Thomas J. Chubb, City of New York.

Claim.—"Effecting a separation of a thin layer of finely pulverized ore into layers, or strata of different specific gravity, upon a perforated bed, or its equivalent, by means

of applying light minute puffs of air up through the interstices of the said bed, and through a thin layer of ore evenly spread and resting thereon, for the purpose of gently agitating the said layer of ore, and floating the lightest substances therein to the top thereof, and allowing the heaviest substances therein to gravitate to the bottom of the said layer on the said bed."

128. For an *Improved Swage for Setting Saw Teeth;* Pearson Crosby, Fredonia, New York.

Claim.—"Forming the acute angle of the acting face of the swage, to bring the cutting edge of the saw teeth to a sharp angle by making the said swage in two parts."

129. For an *Improvement in Brick Machines;* P. S. Devlan, Reading, Pennsylvania.

Claim.—"In combination with a clay receptacle supplied by a positive feed, and a rocking or partially rotating mould wheel, the plungers, the first for pressing, and the second for delivering the pressed brick, the parts being so arranged as that said wheel will rock or roll from one plunger to the other."

130. For an *Improvement in Washing Machines;* Hiram F. Everitt, Benton, Pa.

Claim.—"The combination of the adjustable reel, fluted concave, and swinging rubber."

131. For an *Improvement in Self-waiting Tables;* Wm. B. and Jonathan H. Farrar, Evans Mills, North Carolina.

Claim.—"The central revolving disk (when fitted down into the circular hole), constructed with a thin lip projecting horizontally from the upper portion of its circumference, and with a rib of ring-form projecting from its underside and near its circumference."

132. For an *Improved Pin Sticking Machine;* Thaddeus Fowler, Waterbury, Conn.

Claim.—"1st, The endless chain with its racks, in combination with the flanched cylinders (whether with or without the revolving hopper). 2d, The combination of the endless chain with the revolving hopper."

133. For an *Improvement in Ships' Berths;* Henry Getty, Brooklyn, New York.

"My invention is designed especially for use on ship board, where two things are very essential in a berth, to wit: a capability, when in use, of maintaining a horizontal position, no matter what may be the motion of the vessel, and when not in use, of being turned up against the wall, so as to be out of the way, and thus give increased space for moving round in small state rooms."

Claim.—"Providing at each end or side of a state room of a steamer or vessel, a pivoted bracket which is capable of vibrating in the path of a circle a certain distance, and connecting the berth to said brackets through swinging vertical screw rods, metal or rubber springs, and hollow standards."

134. For an *Improvement in Washing Machines;* Wm. M. Hammond, Jonesville, Michigan.

Claim.—"The bed formed of loose weighted balls covering the tub bottom, in combination with the cellular disk rubber."

135. For an *Improved Method of Rendering the Mouths of Trunks, Mail-bags, &c., Water-tight;* Charles H. Hinckley, Stonington, Connecticut.

Claim.—"The application of the inflated casements or ribs, composed of india rubber, or other suitable material, to the sides of contact of clasps for bags or cases, so that by their yielding contact the clasp may be closed so as to be impervious to water."

136. For an *Improvement in Hay and Manure Forks;* William Jones, Speedsville, New York.

Claim.—"Casting the ferrule upon, or otherwise securing it firmly to, the outer end of a socket, in which are formed slots for the reception of the tangs of the tines of a fork to prevent lateral working, when used in connexion with a wedge, cast or otherwise, formed between the recesses made for the tangs to prevent end play, and screws, for the securing of the tines, socket, and handle to each other."

137. For an *Improvement in Steam Pressure Regulators;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"Supporting the disk by concentric rings and rods."

138. For an *Improved Projectile for Rifled Cannon;* Theodore T. S. Laidley, of the U. S. Army.

Claim.—"The formation of a cast iron shot or shell with a wrought iron covering of a portion or whole, which is fastened to the main body of the shot at or near both ends, by imbedding one or both turned in ends in the cast metal of the shot, or by means of dowels, pins, or rivets, imbedded in the cast metal, and joining the two metals, the body with the covering, firmly and securely, or by a combination of these methods, leaving an intermediate portion of the covering free to be expanded by the action of the gases of the discharge passing through certain channels or passages between the covering and the body of the shot made or left for that purpose. Also, making the wrought iron covering thicker at its rear end, which admits annular spaces being cut into it to hold grease, or for the action of the atmosphere to keep the ball true in its flight, as in the improved ball for muskets, and also throws the bearing parts of the projectile nearer the centre of gravity, insuring greater accuracy."

139. For an *Improvement in Washing Machines;* Justin Loomis, De Ruyter, New York.

Claim.—"The tubular guide piece, forked brace joint, swivel pin, and socket, in combination with the braces and the rubber shaft."

140. For an *Improvement in Cupola Furnaces;* Philip W. Mackenzie, Jersey City, New Jersey.

Claim.—"Forming a continuous sheet of air as indicated, where it is brought in contact with the fuel, in combination with the elongated form and increased size below where the blast enters the fuel."

141. For an *Improvement in the Cutting Apparatus of Harvesters;* Pells Manny, Waddams' Grove, Illinois.

Claim.—"The method of constructing the fingers of the cutting apparatus of harvesting machines of two members, and securing them upon the finger bar. Also, the recesses in the inner faces of the fingers, in combination with the supplementary inclined cutters projecting above and below the sickle."

142. For an *Improvement in Ships' Capstans;* Charles E. Marwick, Portland, Me.

Claim.—"The combination of the key-ring, the recessed lip, and the socketed head, as constructed and arranged together, and applied to the capstan barrel and the driving shaft of the multiplying gearing."

143. For an *Improvement in Water Vessels for imparting Humidity to Hot Air, and Vapor Draft to the Grate Bars of Hot Air Furnaces;* Wm. Moultrie, City of New York.

Claim.—"The structure, location, and application of the water vessel, whereby either or both of said objects are attained in connexion with furnaces and other heating apparatus."

144. For an *Improvement in Cooking Ranges;* Samuel Pierce, Troy, New York.

Claim.—"The combination of the recess between the ovens, having a division plate therein open at the top with the bottom flue, so as by the action of the draft of said bottom flue, to cause a circulation in said recess."

145. For a *Photogalvanographic Process for Printing;* Paul Pretsch, Austria.

Claim.—"The peculiar adaptation of the photographic process to the production of metallic and other surfaces suitable for printing, and for various other useful and ornamental purposes."

146. For an *Improved Boring Machine;* Emmett Quinn, Trenton, New Jersey.

Claim.—"The combination of the sliding guide, with the levers and timber carriage."

147. For an *Improved Bending Machine;* Lewis Raymond, City of New York.

Claim.—"The combination of three rollers, convex and concave, so as to bend sheet metal transversely and longitudinally at one operation. Also, in combination with the above, I also claim a supporting roll."

148. For an *Improvement in Glass Furnaces;* Samuel Richards, Philadelphia, Pa.

Claim.—"The arrangement of the drying ovens, the flue, and the endless carrier, and the schutes, in combination with the glass furnace."

149. For an *Improved Ink-stand;* Thomas Robjohn, City of New York.

Claim.—"The arrangement for flexing the elastic diaphragm by so attaching a mechanism in connexion with a cover for the ink cup, that the opening and closing thereof shall effect the raising or discharge of the ink, or other fluid, into or from said cup."

150. For an *Improvement in Looms;* Edwin A. Scholfield, Westerly, R.I.

"The principle of my invention consists in drawing the cam-wheel which acts on the harness, not by a uniform motion, but by an intermittent and variable motion; its periods of intermission and change coinciding with those of the springing or changing of the harness."

Claim.—"The driving a revolving cam or tappet wheel which acts to spring the harness, or produce a shed, in weaving by an intermittent or variable motion by the use of star gears."

151. For an *Improvement in Washing Machines;* Isaac A. Sergeant, Springfield, Ohio.

Claim.—"1st, The employment within a water-tight tub of an adjustable rotating perforated platform or secondary tub. 2d, Providing the outer end of roller with a shoulder of larger diameter than the body of the roller."

152. For an *Improvement in the Packing of Rotary Steam Engines;* Gerard Sickles, Brooklyn, New York.

Claim.—"The application of loose metal rings to pack the revolving heads which carry the pistons to the stationary heads of the cylinders of rotary engines and pumps."

153. For an *Improved Fence for Poultry Yards;* William P. Thomas, Whitewater, Indiana.

Claim.—"The combination of the swinging frame with posts. Also, the swinging board, in combination with the swinging frame."

154. For an *Improvement in Vibrating Shears;* John Toulmin, New Worcester, Massachusetts.

"This invention consists in the manner of hanging the movable blade of a pair of shears, so that the position of said blade can be adjusted with the greatest accuracy, whereby the shears can be constantly kept in good cutting order."

Claim.—"Hanging the movable blade of a pair of shears by two adjustable centre pivots upon an adjustable pillar block, and for the purpose of so adjusting the movable blade of said shears as to give it the most effectual shearing position in relation to the stationary blade."

155. For an *Improved Method of Clamping Logs in Cross-cut Sawing Machines;* Stephen Woodard, New London, New Hampshire.

Claim.—"Holding the wood to be sawed by means of holders acted upon by the toggle joints weighted at their centres."

156. For an *Improvement in Washing Machines;* Abram Wood, Camden, N. York.

Claim.—"The hinging of the board so that the disk and its shaft may be conveniently raised out of the tub and thrown back while the clothes are handled, and again conveniently let down for the operation, and by which arrangement the whole machine including the bench may be lifted and moved from place to place."

157. For an *Improvement in Sewing Machines;* Wm. Wickersham, Boston, Mass.; patented in England December 29, 1854.

Claim.—"1st, A fast stitch made by one thread, which is formed by having the loop or double of the thread pass through from one side of the cloth to the other, and back again in another place to the first side of said cloth, and around the same thread of which the loop is formed by means of a shuttle carrying said thread through said loop. 2d, A thread guide with a notch or opening in one side of it to receive the thread, and formed so that the thread may pass into it, when said thread is to be guided into the eye or hook of the needle, and pass out of said notch in the thread guide at other

times. 3d, The use of a double hooked needle in taking the thread both ways through the cloth, one way or up through the cloth by means of one hook, and the other way or down through the cloth by means of the other hook of the same needle."

158. For an *Improvement in Sewing Machines;* Wm. Wickersham, Boston, Mass.; patented in England December 29, 1854.

Claim.—"1st, The method of taking up the slack thread above the cloth by means of the shuttle, that is, when the needle descends after having taken the thread up through the cloth, and to its greatest distance above said cloth, drawing down through the cloth the end of the thread connected with the shuttle by means of the shuttle receding from the needle, as the needle descends, thereby preventing the liability of the thread getting under the point of the needle as said needle passes down into the cloth, by thus keeping said thread straight or nearly so until said needle point is sufficiently near said cloth that there is no further liability of the thread raising under it. 2d, The formation of a seam of one thread which cannot be unraveled, of stitches each of which is made by having the loop or double of the thread passed through from one side to the other of the cloth, and back again in another place to the first side of said cloth, and a loop formed by means of a hook needle, and then by having the same thread of which said loop is formed, passed through said loop, and the loop drawn up to the cloth around the thread thus passed through it by means of the shuttle."

159. For an *Improvement in Automatic Rakes for Harvesters;* John W. Brokaw, Assignor to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The arrangement of the spring guide and double guide bar, in combination with the rake head and carrying friction rolls. Also, the friction rolls, in combination with the sleeve rake head and guide rod."

160. For an *Improvement in Sewing Machines;* Henry Behn, Assignor to self and Thomas Sewell, City of New York.

Claim.—"The specific looping device consisting of two pointed bars, the one moving in a plane above the plane of motion of the other, and operating in combination with the needle in such manner, that the loop is formed and held open by bending the thread out of a straight line in opposite directions."

161. For an *Improvement in Sewing Machines;* Samuel Larkin, Assignor to Wheeler & Wilson Manufacturing Co, Bridgeport, Connecticut.

Claim.—"A spring forceps, in combination with a spindle, or equivalent means of supporting the spool."

162. For an *Improvement in Cultivators;* Charles H. Sayre, Utica, Assignor to self and Samuel Remington, Ilion, New York.

Claim.—"A combined horse hoe, and double mould board plough."

163. For an *Improvement in Boot Crimps;* Wm. W. Willmott, Assignor to self, Amos H. and Charles H. Brainard, Boston, Massachusetts.

Claim.—"1st, The device for operating the pincers, consisting essentially of the block, the screw, the spring, ratchet, and pawl. 2d, The device for the purpose of securing the jaws to the stand, consisting essentially of the slit, with its shoulders, and the tenon, with its shoulders."

164. For an *Improved Machine for Folding Paper;* C. P. Wiggins, A. H. Nordyke, and Benjamin Strawbridge, Richmond, Indiana.

Claim.—"1st, The combination of the cam-wheel, with lever, pinion, shaft, drum, cords and blade. 2d, The combination of the cam-wheel with levers, pinions, shafts, and drums, for the purpose of producing an alternate movement of the blades. 3d, The combination of jaws or clamps and lever, with blade to prevent retraction of the paper."

Additional Improvement.

1. For an *Improvement in Hoisting Winches for Ship-board;* Joel Bryant, Brooklyn, New York; patented April 7, 1857; additional dated August 11, 1857.

Claim.—"The invention and use of winches (or compound winches) for hoisting."

RE-ISSUES.

1. For an *Improved Method of Making Wire Strengthened Spoons;* Charles Parker, Meriden, Assignor to Wm. Mix, Prospect, Connecticut; patented May 1, 1849; re-issued August 4, 1857.

Claim.—"Casting the spoon handle in a mould of larger dimension than the finished handle is required to be, and subsequently swaging the handle into the proper shape, and condensing the metal upon the strengthening wire by means of the drop press and die."

2. For an *Improvement in Distributing Apparatus for Flouring Mills;* Alfred T. Clark, Lancaster, Pennsylvania; patented June 30, 1857; re-issued August 4, 1857.

Claim.—"The double series of spouts and valves, arranged and connected with the bolting chamber. Also, the arrangement of the conveyor, in combination with a double series of valves and spouts."

3. For an *Improvement in Rice Hullers;* Peter McKinlay, Charleston, South Carolina; patented April 1, 1851; re-issued August 11, 1857.

Claim.—"Operating the pestle by having it attached to a rod passing through the bottom of the mortar, and receiving motion through a crank, or its equivalent."

4. For an *Improvement in Boot Crimps;* J. M. Read, Boston, Assignee (through Abraham Thayer) of Josiah Copeland, Weymouth, Mass.; patented January 20, 1844; re-issued August 11, 1857.

Claim.—"Arranging the block and clasps, so that the turning up of the straining screw shall at the same time perform the double operation of confining the ends of the leather between the block and clasp, and of stretching the leather over the boot form."

5. For an *Improvement in Reed Musical Instruments;* Jeremiah Carhart, City of New York; patented December 28, 1846; re-issued June 24, 1856; re-re-issued August 18, 1857.

Claim.—"So connecting the board which contains the reed seats or perforations for the reeds with the exhausting bellows, that it shall form substantially a part of the stationary leaf or cover of the exhaust chamber thereof, while the exhausting or pumping chamber is placed in immediate connexion with the said exhaust chamber without the intervention of tubes, thus improving the tone of the reeds, expediting their speaking, and giving a compact, light, convenient, and graceful form to the instrument. Also, the reed cells, in combination with the reed seats or openings. Also, the concentrating chamber, in combination with the reed cells and reed seats. The last two combinations only when they are to be used with a suction or exhaust bellows, capable of producing a continuous current of air through the reed."

6. For an *Improvement in Glass Journal Box;* Edward Campbell, Columbus, Ohio; patented August 21, 1855; re-issued August 25, 1857.

Claim.—"A journal box composed of a metal shell or body, and anti-friction lining surface of vitreous material, when said vitreous material is combined with its metal back."

7. For an *Improved Automatic Regulator for Wind-Wheels;* Joseph Dunkley, Carrollton, Missouri; patented January 30, 1857; re-issued August 25, 1857.

Claim.—"1st, The combination and arrangement of the air passages, with the peculiar devices, for the purpose of making a self-regulating wind-wheel. 2d, The swinging wing and slide. 3d, The peculiar arrangement of slats, cord and weight."

8. For an *Improvement in Ovens;* Wm. E. Treadwell and Wm. Hustace, Executors of E. Treadwell, dec'd., City of New York; patented July 19, 1853; re-issued August 25, 1857.

Claim.—"1st, The combination of flues and furnaces with an endless apron, or its equivalent, whereby the amount of heat imparted to either side of an apron or chain may be regulated independently. 2d, In combination with an endless apron and oven, or their equivalents, discharging and charging apertures, located in such manner that dough may be charged and withdrawn in lines perpendicular or nearly so to the line of motion of an endless apron."

9. For an *Improvement in Capstans for Steamboats;* John Schaffer, West Manchester, Pennsylvania; patented October 21, 1856; re-issued August 25, 1857.

Claim.—"The drum on the shaft of the capstan, as arranged, the capstan being steam driven by geared shafting connecting it with the 'little nigger,' and the whole being combined and made operative through the pulley."

DESIGNS.

1. For *Statues of General Warren;* Henry Dexter, Cambridge, Assignor to William Carleton, Charlestown, Massachusetts.

Claim.—"The photographs represent a statue of General Warren, of full length, with military boots and military frock coat, the vest buttoned up at the throat, with the left foot slightly advanced, the left hand in a position crossing the body, the right hand resting on the hilt of a sword, the point of which rests on a pedestal. The figure is represented without a hat, with the hair curled at the sides of the head."

2. For *Stoves;* J. J. Dulley and Russell Mann, Troy, Assignors to George W. Eddy, Waterford, New York.

3. For *Stoves;* S. W. Gibbs, Assignor to Young & Brother, Albany, New York.

4. For *Cooking Stoves;* Elias Young, Cincinnati, Ohio.

5. For *Stoves;*
6. For *Stoves;*
7. For *Stoves;*
8. For *Stoves;*
9. For *Stoves;*
10. For *Stoves;*

Thomas Barry, City of New York; dated August 25, 1857.

11. For *Stoves;*
12. For *Stoves;*
13. For *Stoves;*
14. For *Stoves;*
15. For *Stoves;*
16. For *Stoves;*

Samuel H. Ransom, Albany, New York; dated August 25, 1857.

17. For *Clock Case Fronts;* Pietro Cinquinni, West Meriden, Connecticut; dated August 25, 1857.

18. For *Brick;* G. W. Sholl and Charles Stewart, Cincinnati, Ohio; dated August 25, 1857.

19. For *Stoves;* Thomas D. Worrall, Lowell, Mass.; dated August 25, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

SEPTEMBER 1.

1. For an *Improvement in Machines for Cutting Corn Stubble, &c., on Ground preparatory to Ploughing;* John Augspurger, Trenton, Ohio.

Claim.—"The combination with the teeth of a rake, of rotating knives."

2. For an *Improvement in Thills for Two-wheeled Vehicles;* Philip Baillau, City of New York.

Claim.—"The flat spring, or its equivalent, at the back end of the thills."

3. For an *Improvement in Sealing Cans;* Edwin Bennett, Baltimore, Maryland.

Claim.—"The construction of a cap formed with a flaring lip-like rim, and groove or gutter, and combined with a stopper part, arranged and applied to an inverted jar or other receptacle."

4. For an *Improvement in Rakes;* Andrew J. Blodgett, Newport, New Hampshire.

Claim.—"Making each arched brace rod and one or two teeth in one piece of wire, and extending the same through the rake head, and into or through the handle."

5. For an *Improved Machine for Wiring Blind Rods;* Byron Boardman, Norwich, Connecticut.

"My invention consists in the employment or use of two feeding devices, one of which feeds the staples between the guides which conducts the staples to the rod, and the other feeds the rod along underneath the guides to receive the staples, so that they may

be driven into the rod at equal distances apart—the above parts being used in connexion with a driving device for forcing the staples into the rod—and the whole so arranged as to operate automatically and in a perfect and expeditious manner."

Claim.—"The means employed for feeding the staples between the guides and underneath the die or rod, that is to say, the plate, pivoted to the plate on which the staples are placed, and provided with the shoulders, the plate being connected with the bar by means of the rod. Also, feeding the rod underneath the guides to receive the staples by means of the bar attached to the bent lever in connexion with the lever, said parts being operated by their respective springs, and also by the bar. Further, the guides to convey the staples to the rod, and at the same time also allow to expand, so as to prevent the clogging of the same, in combination with the die or rod for driving the staples into the rod."

6. For an *Improved Machine for Spooling Thread;* Charles K. Bradford, Lynn, Mass.

"This invention is to enable a person to wind thread expeditiously, upon a small bobbin or spool; such for instance as may be used in an ordinary sewing machine."

Claim.—"The improved mode of regulating the winding of the thread, that is, by causing the thread carrier to rest directly against, and be moved and guided in its movements by, the side of the helix coil on the bobbin."

7. For an *Improvement in Coal Sifters;* Wm. D. Brown, Weymouth, Mass.

Claim.—"The combination of the screen and the plates placed in a vessel or machine to be used as a portable coal hod and sifter, so suspended on an axis as to allow of an oscillating or swinging movement."

8. For an *Improvement in Seeding Machines;* Charles W. Cahoon, Brooklyn, New York.

"This invention consists in the novel means employed for discharging broad cast the seed or fertilizing material, whereby the work is done in a perfect manner."

Claim.—"The disk and rock shaft, with its teeth, in combination with the funnel-shaped discharger having spiral flanches."

9. For an *Improvement in Straw Cutters;* Aury G. Coes, Worcester, Mass.

Claim.—"My improved straw cutting machine, so that its bed and knife shall operate with a compound motion produced by a lever crank, fulcrum rod and guides, arranged so as to operate together."

10. For an *Improved Ore Separator;* Thomas J. Chubb, City of New York.

Claim.—"1st, The employment in combination with an inclined perforated table or bed and a bellows, of a number of channels applied and arranged relatively to the bed and to each other, to convey away the separated substances in different directions. 2d, The division of a bellows, applied and operating in connexion with a perforated bed for the separation of articles of different specific gravity into numerous chambers or compartments, each having its separate valve or valves, and constituting in itself a complete bellows."

11. For an *Improvement in Machines for Washing Bottles;* Henry N. Degraw, Watervleit, New York.

Claim.—"The expanding brush, formed of the brush bars connected to the rod and bar, and expanded and contracted by the lever and spring, when said brush thus arranged and operated is used in connexion with the sliding holder."

12. For an *Improved Machine for Swedging Hatchet Heads;* Levi Dodge, Cohoes, New York.

Claim.—"The apparatus, viz: the block cheeks and former."

13. For an *Improved Machine for Sawing Staves;* Peter Deal, Amsterdam, and James Greenman, Northampton, New York.

"Our improvements relate to that class of machines for sawing staves, in which a cylindrical saw is used to sever the staves from the stock."

Claim.—"1st, The combined method of supporting and driving cylindrical saws from their periphery. 2d, The arrangement on the interior of a cylindrical saw of a supporting table, and an adjustable gauge or guide, by which the thickness of the stave is gauged, and it is guided during its passage through the saws, and one stave is prevented from passing each other, and jamming against and stopping the saws, or throw-

ing the front stave off the side of the table on the bottom of the saws. 3d, The arrangement of a guard plate on the interior of a cylindrical saw, for the purpose of preventing the saw-dust chips being thrown into the kerf of the stave. 4th, The method of diminishing the pressure of the curved surface of the stock against the periphery of a cylindrical saw, by pivoting the track on which the carriage holding the stock traverses, so that the pressure of the forward end of the stock will throw the track outward, and thus prevent the saw from binding in the kerf."

14. For an *Improved Saw Clamp;* Leonard O. Fairbanks, Bridgeton, Maine.

Claim.—"My improved saw clamp as made with its jaws, clamping device, adjusting screws, and bed plate. Also, making the stationary jaw with a groove arranged in it, in manner and so as to operate with the movable jaws, when constructed and made to act with respect to the stationary jaw and bed plate."

15. For an *Improvement in Life Preserving Berths for Steam and other Vessels;* Elbridge Foster, Hartford, Connecticut.

"This invention consists in the construction of movable and adjustable berths, with inflated elastic keels, to be used as a life preserver on steam and other vessels."

Claim.—"The adjustable inflated keels."

16. For an *Improved Device for Locking Faucets;* Henry Getty, Brooklyn, New York.

"This invention relates to an improvement in that class of faucets in which a spring is employed, in connexion with static pressure for keeping the valve closed."

Claim.—"In combination, the L shaped grooves at the upper part of the spring barrel, stop bar, and the secret stop arm, placed loosely over the valve stem, and attached to screw collar, whereby facilities are offered for fastening the faucet closed, and also when necessary, of placing it beyond the control of servants, and others not entrusted with its management."

17. For an *Improvement in Animal Traps;* George Hart, Granger, Ohio.

Claim.—"The arms, springs, and ring."

18. For an *Improved Method of Operating the Cutters of Harvesting Machines;* James Haviland, Milton, New York.

Claim.—"Imparting the requisite movements to the cutter blade of a harvesting machine, by means of the spirally grooved intermediate shaft, and the series of hemispherical or oval headed teeth, projecting from the face of the main bearing wheel, and operating upon the said intermediate shaft."

19. For an *Improvement in Spirit Stills;* Edward Herring, Walton on Thames, England.

"The nature of my invention consists in certain improvements in stills, whereby their evaporating power is increased, the movement of the wash facilitated, and the cleansing of the still rendered easier and more perfect; said improvements being specially intended to adapt to the requirements of American distilling, in which a thick and heavy wash is employed, the best distillatory apparatus used in Europe."

Claim.—"1st, Giving to the diaphragms which separate the chambers, an inclination or fall towards alternate sides of the still. 2d, The introduction of hot air for the purpose of aiding in the evaporation of the wash, and keeping it in agitation to prevent the clogging of the still."

20. For an *Improvement in Surf and Life Boats;* Richard C. Holmes, Cape May Court House, New Jersey.

Claim.—"Constructing a boat of the peculiar form, and giving to a boat of that form buoyant ends, a ballasting tank, and freeing valves."

21. For an *Improved Raking Device for Harvesters;* Stephen R. Hunter, Cortlandt, New York.

"My invention consists in the employment or use of two gates applied to the machine, whereby the cut grain is deposited upon the ground in sheaves or gavels."

Claim.—"The rod, or its equivalent, and two gates applied to the machine, the gates being operated from the wheel by means of the cam, crank shaft, rod and arm."

22. For an *Improved Hub for Carriage Wheels;* James W. Jackson and Luther W. Burchinal, Smithfield, Pennsylvania.

Claim.—"Making the mortises of the hub adjustable in two different directions, so

that the spokes of the wheel shall be grasped on their four sides simultaneously when the two plates of the hub are forced together by the screw-bolts."

23. For an *Improved Feed and Gigging Movement for Sawing Mills;* George D. Lund, Yonkers, New York.

Claim.—"The combination of the two cones, the conical hub or boss and pinion on the sleeve or collar, placed on the sliding shaft of the cone, and the gearing."

24. For an *Improvement in Sack Fastener;* Wm. P. and Jacob E. B. Maxson, Albion, Wisconsin.

Claim.—"A bag or sack fastener consisting of a spring tongue pressing the string against a side flanch or projection, so as to form a self-holding nipper clutch, when the said sack fastener is made of a single piece of metal cut and bent."

25. For an *Improvement in Chimney Caps;* Ira Mayhew, Albion, Michigan.

Claim.—"The constant openings immediately beneath the drip of the roof, in combination with the larger variable openings, which are furnished with valves, hung at points and separated by the connecting rods below."

26. For an *Improvement in Shower Bath Apparatus;* William Meyer, Progress, New Jersey.

Claim.—"The lower rose, by means of which water can be thrown upwards, and a more perfect and thorough shower bath is obtained."

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Chemical Changes which Pig Iron undergoes during its conversion into Wrought Iron.** By F. Crace Calvert, F.C.S., and M.R.A., of Turin, and Richard Johnson, Esq.

Wishing to make some improvements in the manufacture of iron, we carefully examined the various analyses which had been made of pig iron and wrought iron; but we found that no comparison could be made between the recorded results, as the samples analyzed had been obtained from different sources, and also as no detailed analysis had been published of the various chemical changes which pig iron undergoes in the process of puddling during its conversion into wrought iron. We therefore decided to undertake this task, with the hope of throwing some light upon this important operation in the manufacture of iron, and of thereby enabling practical men to make those improvements in the puddling of iron which on many accounts are so much to be desired.

To fully investigate and closely follow the progressive and interesting chemical changes which pig iron undergoes during its conversion into wrought iron, we took samples every five or ten minutes after the pig iron had melted in the furnace. These chemical actions are clearly defined in the furnace by the peculiar appearance which the mass assumes as the operation proceeds.

It is necessary that we should describe in a rapid manner the physical conditions which pig iron assumes during its conversion into wrought iron. When first heated in a puddling furnace, it forms a thick, pasty mass, which gradually becomes thin, and as fluid as mercury. When it has reached this point it experiences a violent agitation, technically called "the boil," which is produced no doubt by the oxidation of the

* From the Lond., Edin., and Dublin Philo. Mag., Sept., 1857.

carbon, and the escape of the carbonic oxide then generated. During this period of the operation the mass swells to several times its primitive bulk, and the puddler quickly agitates the melted mass to facilitate the oxidation of the carbon. After a short time the mass gradually subsides; the puddler then changes his tool, and takes the "puddle" to gather with it the granules of malleable iron floating in the melted mass of scoria or slag. The granules or globules of iron gradually weld together and separate from the scoria; and this separation is hastened by the puddler gradually forming large masses, called balls, weighing about 80 lbs., from which the scoria drains out. This part of the operation requires great skill in the puddler; for nearly the whole of the carbon has been oxidized, so that if the current of air is not managed with great care, the iron itself is oxidized, or as it is technically termed, "burnt;" and thus not only does great loss ensue in the quantity of malleable iron produced, but also the iron containing a certain quantity of oxide of iron is brittle, and of bad quality.

We shall now examine the various chemical changes which pig iron undergoes during its conversion into wrought iron.

The iron we took for our experiments was a good cold-blast Staffordshire iron; the pig was rather gray, being of the quality used for making iron wire, or a gray No. 3. Its composition was as follows:

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·320	2·230	2·275
Silicium, . .	2·770	2·670	2·720
Phosphorus, . .	0·580	0·710	0·645
Sulphur, . .	0·318	0·288	0·301
Manganese and aluminium,	traces.	traces.	
Iron, . . .	94·059	94·059	94·059
	100·047	99·957	100·000

224 lbs. of the above pig iron were introduced at 12 o'clock, on the 4th of April, 1856, into a puddling furnace which had been cleaned out with malleable iron scraps. After thirty minutes the pigs began to soften and to be easily crumbled, and ten minutes more had hardly elapsed when they entered into a state of fusion. The first sample was taken out of the furnace at 12h 40m P.M., from the centre of the melted mass with a large iron ladle and poured on a stone flag to cool. The flue of the furnace, which up to this time had been kept open, was now nearly closed by a damper at the top of the chimney, so that the products of combustion came out by the door of the furnace and other openings, whilst little or none escaped by the chimney.

Appearance of the Sample.

On breaking the sample as taken out of the furnace, it had no longer the appearance of gray No. 3 pig iron, but a white, silvery, metallic fracture, similar to that of refined metal. The rapid cooling of the sample was no doubt the cause of the change noticed, for it contained

quite as much carbon as the pig iron used; and further, the carbon was in a very similar condition, as in both cases a large quantity of black flakes of carbon floated in the acid liquors in which the iron was dissolved. The following is the amount of carbon and silicium which the above sample contained per cent. :—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·673	2·780	2·726
Silicium, . . .	0.893	0·938	0·915

These results are highly interesting, as they show that the iron had undergone during the forty minutes which it had been in the furnace, two opposite chemical changes; for whilst the proportion of carbon had increased, the quantity of silicium had rapidly decreased. This curious fact is still further brought out by the sample which we took out of the furnace at 1 P.M., or twenty minutes later than the last sample analyzed, as is shown in this Table :—

	Carbon.	Silicium.
Pig iron used, ...	2·275	2·720
1st sample taken out at 12h 40m, .	2·726	0·915
2d " " 1h 0m, .	2·905	0·197

Therefore the carbon had increased 0·625, or 21·5 per cent. of its own weight, and the silicium had decreased in the enormous proportion of above 90 per cent. It is probable that these opposite chemical actions are due, in the case of the carbon, to the excess of this element in a great state of division or in a nascent state in the furnace, and that under the influence of the high temperature it combines with the iron, for which it has a great affinity, whilst the silicium and a small portion of iron are oxidized and combined together to form protosilicate of iron, of which the scoria or slag produced during this first stage of puddling consists, and which plays such an important part in the remaining phenomena of the puddling process.

2d Sample, taken out of the furnace at 1h 0m P.M.

This sample contained the following quantities of carbon and silicium :—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·910	2·900	2·905
Silicium, . . .	0·226	0·168	0·197

It had the same white, silvery appearance as No. 1; but had this difference, that it was slightly malleable under the hammer, instead of being brittle like No. 1. The scoria also was on the upper surface of the mass when cold, and not mixed with the metallic iron, as in succeeding examples.

3d Sample, taken out at 1h 5m P.M.

The mass in the furnace having become very fluid, and beginning to swell or enter into the state called "the boil," a small quantity was ladled out. When cold it was quite different from that of the two previous ones, being composed of small globules adhering to each other, and mixed with the scoria; the mass therefore was not compact, like

the former ones, but was light and spongy; its external appearance was black, and the small globules when broken presented a bright metallic lustre, and were very brittle under the hammer. We had for some time considerable difficulty in separating the scoria from the globules of iron; but we found that by pulverizing the whole for a long time, the scoria was reduced to impalpable powder, and by sieving we could separate it from the iron, which was much less friable. The iron thus cleansed from its scoria gave us the following results:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·466	2·421	2·444
Silicium, . . .	0·188	0·200	0·194

4th Sample, taken out at 1h 20m P.M.

As soon as the last sample had been taken out, the damper of the furnace was slightly raised so as to admit a gentle current of air, which did away with the smoke which had been issuing from the puddler's door, and a clear and bright flame was the result. This was done, no doubt, to facilitate the oxidation of the carbon of the iron, and to increase this action the puddler quickly agitated the mass. Under these two actions the mass swelled up rapidly, and increased to at least four or five times its original bulk; and at 1h 20m, the mass being in full boil, this 4th sample was taken out. Whilst cooling, it presented the interesting fact, that in various parts of it small blue flames of oxide of carbon were perceived, no doubt arising from the combustion of carbon by the oxygen of the atmosphere. It is curious that this phenomenon was not observed in the previous samples. It is due probably to the following causes: first, that the cast iron, having been brought by the boil to a state of minute division, offers a large surface to the action of the oxygen of the air, and thus the combination of the oxygen with the carbon of the iron is facilitated: and second, that at this period the carbon seems to possess little or no affinity for the iron; for one of us has often observed that when pig iron, rich in graphite, is puddled, the carbon is liberated from the iron; for if a cold iron rod is plunged into the mass of melted iron in the puddling furnace, it is covered with iron and abundant shining scales of graphite carbon.

The appearance of this No. 4 sample was most interesting; and the best idea that we can give of it is, that it is so light and formed of such minute granules as to be exactly like an ant's nest. The particles have no adherence to each other, for by mere handling of the mass it falls into pieces. This is due to each particle of iron being intimately mixed with scoria. The granules of iron have a black external appearance, are very brittle under the hammer, and when broken they present a bright, silvery, metallic fracture. The scoria was separated by the method above described for No. 3, and the quantities of carbon and silicium which the iron contained were as follows:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	2·335	2·276	2·305
Silicium, . . .	0·187	0·178	0·182

5th Sample, taken out at 1h 35m P.M.

This sample is a most important one in the series, as it is the first in

which the iron is malleable and flattens when hammered. It was ladled out of the furnace just as the boil was completed, and the swollen mass began to subside. The damper at the top of the chimney was drawn up, so that a very rapid draft was established through the furnace. The puddler also changed his tool, leaving the rubble and taking the puddle to work with. When cold it partakes of the appearance of Nos. 3 and 4 samples, the mass being spongy and brittle, as in No. 4, but less granulated, and like No. 3, being in separate globules, mixed with the scoria. The granules are black externally, but are bright and metallic when flattened. The analysis of these globules proves that the mass of iron in the furnace has lost during the quarter of an hour which has elapsed since the taking of No. 4 sample, a large proportion of its carbon, equal to 20 per cent. of its weight, whilst the silicium, on the contrary, has remained nearly stationary.

	First analysis.	Second analysis.	Mean.
Carbon, . .	1·614	1·681	1·647
Silicium, . . .	0·188	0·178	0·185

6th Sample, taken out at 1h 40m P.M.

The reason why this sample was taken only five minutes after the last sample, was, that the mass in the furnace was rapidly transforming itself into two distinct products, viz: the scoria on the one hand, and small globules of malleable iron on the other. We attached some importance to this sample, as the workman was on the point of beginning the balling or agglomerating the globules of iron, so as to form large balls of about 80 lbs. weight, to be hammered and rolled out into bars. Whilst the mass taken out for analysis was cooling, small blue flames of oxide of carbon issued from it. These were similar to those observed in Nos. 4 and 5, but were not so abundant. The appearance of this sample was very similar to the last one, with the exception that the scoria was not so intimately mixed with the globules of iron, and that these were larger, and slightly welded together when hammered. The proportions of carbon and silicium were as follows:—

	First analysis.	Second analysis.	Mean.
Carbon, . .	1·253	1·160	1·206
Silicium, . . .	0·167	0·160	0·163

When these figures are compared with those of the previous analysis, it is interesting to observe, that whilst the silicium remains nearly stationary, the carbon rapidly diminishes ; for in the five minutes which elapsed between the taking out of the two samples, there was 28 per cent. of the carbon burnt out. This rapid decrease of carbon in the iron is maintained during the remaining ten minutes of puddling. In fact, in one quarter of an hour, viz: from 1h 35m to 1h 50m, the iron lost 50 per cent. of the carbon which it contained at 1h 35m.

7th Sample, taken out at 1h 45m P.M.

This sample was obtained when the puddler had began to ball. The appearance of the sample, although similar to the last, differs from it by the granules being rather larger, and nearly separated from the scoria, which forms a layer at the top and bottom of the mass. These granules

are also much more malleable, for they are easily flattened under the hammer. This last fact is easily accounted for by the small amount of carbon which it contains, as stated above and shown by these results:—

	First analysis.	Second analysis.	Mean.
Carbon,	1·000	0·927	0·963
Silicium,	0·160	0·167	0·163

8th Sample, taken out at 1h 50m P.M.

This last sample was taken a few minutes before the balls were ready to be removed from the furnace, to be placed under the hammer, and was a part of one of the balls which were separated and placed to cool. It was observed that no blue flame issued from the mass as it cooled. The appearance of the sample showed that the mass constituting the ball was still spongy, and granulated similar to the previous ones. The only difference was, that the granules adhered together sufficiently to require a certain amount of force to separate one from the other, and also that they were much more malleable under the hammer. They were found to contain the following quantities of carbon and silicium per cent. :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·771	0·773	0·772
Silicium,	0·170	0·167	0·168

We should observe here, that the black coating which covers the granules of iron, even of No. 8 sample, preserves the iron from all oxidation; for none of the samples became oxidized during the nine months they were in the laboratory, exposed to the atmosphere, and to the various acid fumes floating about. This black coating is probably composed of a saline oxide of iron.

9th Sample.—Puddled Bar.

The balls taken out of the furnace were hammered, and then rolled into bars, and in these we found the following :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·291	0·301	0·296
Silicium,	0·130	0·110	0·120
Sulphur,	0·142	0·126	0·134
Phosphorus,	0·139		0·139

10th Sample.—Wire Iron.

The puddled bars were cut into billets of about 4 feet in length, and heated in a furnace to a white heat, and then rolled into wire iron. The proportion of carbon, silicium, sulphur, and phosphorus, were as follows :—

	First analysis.	Second analysis.	Mean.
Carbon,	0·100	0·122	0·111
Silicium,	0·095	0·082	0.088
Sulphur,	0·093	0·096	0·094
Phosphorus,	0·117		0·117

To complete the series of products in the conversion of pig iron into

wrought iron, we analyzed the scoria or slag which remained in the furnace after the balls had been taken out, and found its composition to be as follows:

Silica,	16·53
Protoxide of iron,	66·23
Sulphuret of iron,	6·80
Phosphoric acid,	3·80
Protoxide of manganese,	4·90
Alumina,	1·04
Lime,	0·70
	100·00

Therefore in the scoria are found the silicium, phosphorus, sulphur and manganese which existed in the pig iron; and probably the phosphorus and silicium are removed from the iron by their forming fusible compounds with its oxide.

We shall conclude this paper by giving our results in a tabulated form, so that the removal of the carbon and silicium may be better appreciated by those who may consult it with the view of obtaining such information as may lead them to those improvements to which we think our investigations tend.

Pig iron used.	Time.	Carbon.	Silicium.
		2·275	2·720
Sample No. 1	12·40	2·726	0·915
" " 2	1·0	2·905	0·197
" " 3	1·5	2·444	0·194
" " 4	1·20	2·305	0·182
" " 5	1·35	1·647	0·183
" " 6	1·40	1·206	0·163
" " 7	1·45	0·963	0·163
" " 8	1·50	0·772	0·168
Puddled bar, 9		0·296	0·120
Wire iron, 10		0·111	0·088

Finally, we wish to express to Mr. Siméon Stoikowitsch our best thanks for the ability and perseverance which he has shown in helping us in these long and tedious analyses.

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*The American Breech-Loading Guns.**

Mr. Eastman's six breech-loading cannon, recently imported from America, were yesterday tried on the Arsenal Wharf, Woolwich, under the supervision of Lieutenant-Colonel Wilmot, Superintendent of Government gun factories at Woolwich, and having been twice fired with a double charge of blank cartridge—namely, 20 lbs. of powder—they were examined, and found to have stood the test satisfactorily. From their enormous weight—17 tons—they did not evince the slightest recoil.

*From the Lond. Mech. Mag., Aug., 1857.

Specification of a Patent granted to PHILIPPE PIERRE HOFFMAN, *for an improved compound to be used for water-proofing fabrics, paper, leather, or other materials.**—[Dated 16th August, 1856.]

This invention consists in the manufacture of coatings impervious to water, and also to air, which may be used for coating fabrics and materials of various sorts, as water-proof awnings or coverings, and may also be applied to leather, paper or paste-board, as a varnish or water-proof coating or paint. Coatings of the compounds hereinafter described are very elastic, supple, and little affected by atmospheric influences, and do not warp, break, or become sticky, but keep dry under all variations of temperature of the atmosphere.

These coatings consist of either a mixture of siccative linseed oil and sulphur, called balm of sulphur, or of a mixture of the said balm of sulphur with a quantity of siccative oil, gum copal, gum opal, gallipot, yellow amber, resin, litsphalt, india rubber, and gutta percha, and with the essences of turpentine or naphtha, &c., these two latter keeping in solution the abovenamed substances, which may be mixed separately or at the same time with the balm of sulphur.

The chief features of the invention consist in the use of the balm of sulphur for rendering fabrics of all descriptions air and water-proof, and in preparing the balm, which, being obtained by the process hereinafter described, contains less sulphur, and has a less offensive smell than ordinary balm of sulphur, yet, at the same time, preserving all the requisite properties. The balm of sulphur is prepared in the following manner:—When the siccative oil has boiled for about two hours, in order to thicken it and separate its mucilaginous parts, which coagulate, it is left a few days to settle previous to decantation: then ten parts, by weight, are taken and submitted to slow boiling, during which small quantities of flowers of sulphur are added, and agitation is kept up the whole time. When from one to two parts of flowers of sulphur have been thus thrown in small quantities into the oily mixture, a transformation soon takes place, and the balm of sulphur now assumes a homogeneous mass of a brownish color, cohesive and elastic, somewhat like india rubber. The constituents of this composition or coating are then the following (by weight):—Ten parts of siccative thickened linseed oil, and from one to two parts of sulphur in powder; in addition to which one part of mixture A, may be added. The mixture A, is separately compounded, as hereinafter described, with oil and resin or gum. If it happens that by too great a heat, and in consequence of the sulphur being thrown in at too short intervals, a quick ebullition ensues, and a mass, almost inelastic, is obtained (which would not answer the desired purpose), to render this useful, it will suffice to submit the material to the action of a second boiling, in a closed vessel, for about two hours, with a properly-managed fire; when the whole will return again to the liquid state, and in such state may be used.

The following is another improvement or manipulation in preparing the balm of sulphur:—A certain quantity of siccative oil is boiled till it has acquired a thickened consistency; balm of sulphur is then added, containing from one-tenth to one-fourth of sulphur, according to the

* From Newton's Lond. Journ., May, 1857.

greater or less quantity of sulphur it is desired that the result should contain. Mixture is effected by the fusion of the two substances together.

The composition of the second coating may consist of the following materials and proportions (by weight):—Forty parts of siccative linseed oil, thickened with seven and a half parts of sulphur in powder; five parts of siccative linseed oil, which, in addition to the boiling, may be further thickened by one part of the mixture A, hereinafter described.

Instead of the flowers of sulphur, as designed for the preparation of the balm of sulphur, roll sulphur, sulphurate of carbon, or chloride of sulphur, may be used.

In preparing the balm of sulphur, as last hereinbefore described, the component parts given are separately treated, which are used and their proportions regulated according to the ultimate purpose for which the coatings are required.

The balm of sulphur, thus prepared, is used as the coating, and liquified either by the action of heat or by means of solvents; such as essence of turpentine, naphtha, &c. When it is desired to obtain a harder coating, gallipot gum, yellow amber, and resin, litsphalt, &c., may be added.

These substances are all to be added one by one; instead of so adding them, a separate mixture, denominated mixture A, may be used.

Mixture A, is prepared in the following manner:—Take, by weight, six parts of siccative linseed oil, thicken it by boiling two hours on the fire, and mix it with four parts of gum or resin. Then melt these substances, and mix with the oil when they are in ebullition.

The mixture of the materials is effected as is usually done for preparing varnishes, the gum or resin and the balm being melted separately, and afterwards mixed together. A solution of india rubber or gutta purcha will increase the adhesiveness of the compound.

These various coatings prepared in the manner described, may be applied in various ways on the fabric or other material or article to be coated. The fabric to be coated is dipped into the material when hot and in the liquid state, from which it is withdrawn and made to pass between six scrapers or cutters adjusted transversly above the vessel; so that any excess of the material is removed by the scrapers or knives, and drops into the vessel again.

The patentee claims, "the methods of preparing, and the preparations of balm of sulphur, as hereinbefore described; to be used as a waterproof coating, separately or in combination with other substances, as hereinbefore set forth."

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*A New Process for the Manufacture of Artificial Marbles.**

An Italian Correspondent sends us some notes on a new process for the manufacture of artificial marbles, invented by the Marchesi Campana. He says, "The Fabri is at San Giovanni, *en route* to Portici. In a large chamber, I found specimens of various species of the marble worked into tables, vases, pedestals, and cornices. Porphyry, rosso antico, giallo antico, brocatello, and other marbles, were there, so the eye declared; and neither myself nor my friends could have distinguished

* From the Lond. Athenæum, June, 1857.

between them and the real marbles. They were marked by the same 'ring' on striking them, by the same appearance in the internal formation, and by the same high polish on the surface. In fact, we were witnesses of the mode of polishing adopted, which resembled exactly that used for marbles, that is to say, pumice-stone and water in the first instance, and a hard, cross-grained stone, here called 'lavagna,' after. Adjoining the fabric, we were shown the roof of a house which had been covered with this material, and had resisted the heat of two summers and the cold and frost of two winters; yet not the slightest impression had been made by either. On the terrace surrounding the house were some loose bits of the marble plaster which had been thrown there, and which, on being examined, presented a flakey appearance, sparkled as fragments of white marble do, and crumbled in my hands. I was not allowed to carry off a piece. After making these observations, I conversed freely with the Directors, who were disposed to give full information as to the results of this wonderful discovery. As yet only two fabrics exist—one in Rome and the other in Naples. In London, an imitation has been attempted; but it is limited in its range, not embracing any other varieties than porphyry, giallo antico, and rosso antico, and it is nothing more than a plaster laid over a hard stone, such as lavagna, whereas the Marmoridea is one solid substance. 'Has it been applied to statuary?' I asked.—'Yes, and the Apollo Belvidere had been recently formed of it—a statue which was not an approximation to a likeness, but which was the express image.' It had been submitted to the observation of the Pope and other eminent persons, who had expressed their high satisfaction with it. The pavement of the Church of St. Chrysomelo, which was very much out of repair, has been beautifully restored with this material, and applications are being made from all quarters for ornaments of it for public and private edifices. The ex-Queen, Maria Christina, has recently given some extensive orders for works of the Marmoridea, and the Empress of Russia has been so pleased with it as to permit a project to be submitted to her for the execution of the Laocoon and other statues, which will, in all probability, be executed for Her Majesty. At the same time, a conditional order has been given for lining the walls of the New Cathedral at Moscow, 14 feet deep, with this material, with a cornice inlaid with imitations of the Byzantine. When I say conditional, it depends on a calculation of the expense, which will be very much increased by the carriage to so great a distance. With this great disadvantage, however, the estimated expense is one-third of what would be the expense of marble, and, leaving carriage out of the question, the expense of the artificial is about one-eleventh of the real marble. Hitherto, the application of the Marmoridea, both in Rome and Naples, has been most successful; and the opinion of all who have seen it is one and the same. Should a longer experience confirm all that we have heard and seen, there can be no doubt but that the material is destined to work a great revolution in Art. There is one observation which I have omitted, which is, that besides its vast variety of applications and its power of reproducing exact copies of our most splendid specimens of statuary, it can create marbles which are now no longer to be found."

Coffee and Milk as an Article of Diet. Experiments of D. A. CARON, Physician to the Prisons of the Department de la Seine.*

Speaking of the popular habit of breakfasting on coffee with milk, he says: I have devoted my attention to this subject, and I think I am justified in attributing to this kind of aliment the production of the nervous and leuchorrhœic diseases which principally affect females of every class, particularly those inhabiting large towns. The very general coincidence of the same symptoms with the use of coffee and milk, induced me to examine what might be the cause of those phenomena, and then I was led to investigate what the action of coffee and milk is, and then the action of that mixture on the human economy. I was first obliged to make the analysis of the infusion of coffee, next to determine its physical and chemical properties; I was obliged besides, to submit my first essays to new experiments, which conducted me to a series of most interesting researches, which I now propose to describe.

The infusion of coffee is a liquor of a dark brown, possessing a particular aromatic taste, slightly bitter; the chemical analysis containing the following principles, viz: a coloring matter soluble in water, a volatile empyreumatic oil soluble in alcohol, which is developed by torrefaction, some tannic and gallic acid, some resin and an extract of cafeine. This liquor when warm and sweetened, constitutes a stimulating and pleasing beverage known by every one, but what no one has thought of is, that when in contact with milk, its nutritious properties are neutralized, because of its fermentation being retarded. Having put together some coffee and milk in a bottle, it was 27 days before the mixture began to decompose, whilst milk and sugar were decomposed in three days; chocolate with milk was five days; pure cafeine and milk eleven days. It is evident that the astringent properties of coffee hinder the digestion of milk; but it happens also, that during the action of coffee on the principle of milk, the cafeine is set free and acts on the membrane of the stomach in the same manner as vegetable alkalies, producing the most evident hyposthenisation, a fact which till now has been overlooked. Then Dr. Caron continues to relate the experiments he made on himself, and some other persons willing to submit to the trial, the results of which were general prostration, vital concentration, cephalagia, weakness and trembling of the legs, tottering walk, nausea supervening with fulness of the stomach, constant somnolence, great want of appetite, he having remained since the morning till 11 o'clock at night without eating anything. But what is particularly worth noticing he adds, is the condition of the pulse, which, on the average, was from 80 to 90, and which, under these circumstances, was lowered to 68. At four o'clock in the afternoon it was reduced to 60, and two hours later to 56, when he took food in order to stop the effect. While taking the meal he was subject from time to time to giddiness, flushing of the face, and nausea; after the meal the pulse rose to 72, when he felt much relieved. He con-

* From the Journal of the Society of Arts, No. 228.

tinues farther on and says: A mixture of coffee and milk, as I have stated above, having the property of hindering the fermentation when in vessels, acts identically in the same manner in the stomach, and constitutes an inert liquid, on which the gastric juice has little or no action at all. Dr. Caron continues the account of his experiments, mentioning cases he has treated, and proves ultimately that many patients laboring under irritation, leuchorrhœa, and hysteria, were restored to health by simple tonic treatment after having given up the use of coffee.

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*Description of Williams's Apparatus for Charging Furnaces.**

Mr. C. Wye Williams, of Liverpool, has patented an apparatus by means of which coal or other fuel may be introduced into a furnace, and distributed rapidly and uniformly therein.

Fig. 1 of the annexed engravings is a longitudinal section of the improved apparatus, prepared ready to receive a charge of fuel; and fig. 2 is a longitudinal section of the apparatus after the discharge of the

Fig. 1.

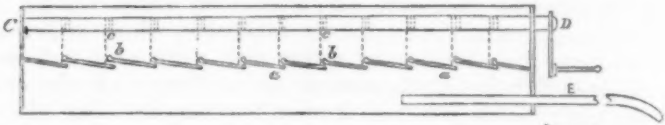
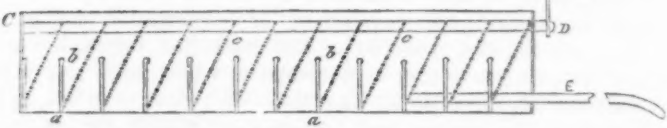


Fig. 2.



fuel through the bottom. It consists of a box or drawer-like apparatus, being open at the top to receive the charge of fuel; *a a* are a series of narrow metal plates, forming the bottom, each moving on pivots, *b b*; *c c* are chains, having one end attached to the horizontal rod or shaft, C D, and the other end secured to the falling edge of each plate, as shown in Fig. 2; D, a winch handle, to rotate the shaft; and EE two handles.

It will be observed that one form of the improved apparatus is of a drawer-like shape, entirely open at the top, the bottom consisting of a series of parallel flat metal plates of any required width, and placed either across from side to side or lengthways from front to back end of the furnace, and are so arranged and attached that they may move somewhat like the laths of a venetian blind. On the shaft, C D, being wound up by the winch handle, the plates forming the bottom are raised and held in their horizontal position by a latch or other suitable catch retaining the winch handle in its place, and on its being removed the shaft is suddenly liberated, when the plates and their respective chains take the position shown in fig. 2. The catch should be so placed that it may be quickly disengaged, and the charging of the furnace completed in a few

* From the Lond. Mech. Mag., Aug., 1857.

seconds of time. Before its being charged with fuel, the box or drawer laying outside the furnace, resting on one or more supports or on the ground, is filled, and on the door being opened, it is run or pushed into the furnace by the handles E E; and on releasing the winch catch the horizontal plates fall suddenly by the weight of the charge of coal or other fuel, each taking a hanging vertical position. By this action the coal falling through the several spaces thus produced is dispersed over the entire surface of the remains of the previous charge, then in an incandescent state, and the box is rapidly withdrawn, and the door again closed. The width of the plates, and that of the spaces between them while hanging vertically, may be made of any required size, according to the nature and size of the fuel for charging wide furnaces; and the side plates, A B, may also be hung on pivots, to deliver the fuel laterally and outwards. For the convenience of using the apparatus, it is furnished with the two handles or bars, E, projecting like the handles of a wheel-barrow on each side, and of any convenient length, so that the stoker standing between them may have full command of the box and the operation of charging with it; its weight being, when pushed in, supported by a cross-bar or like means within the furnace while in the act of being pushed in and drawn out.

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*Statistics of Textile Manufactures of Great Britain.**

The number of factories from which schedules were received by the factory inspectors in 1856, amounted to 5117 against 4600 in 1850, and 4217 in 1838. Of these, 2210 were cotton factories, 1505 woolen, 525 worsted, 417 flax, and 460 silk. The cotton factories have increased 14·2 per cent., and the silk 66 per cent. The woolen trade is becoming concentrated in Yorkshire, and the worsted manufacture is almost exclusively confined to the same county. The flax trade is most vigorous in Ireland. The number of spindles and looms in 1856 was respectively 33,503,580 of the former, and 369,205 of the latter, and the actual horse power given in the returns is 161,435. Power looms have increased from 115,801 (in 1836,) to the number already indicated—viz: 369,205. The average value of the cotton goods and yarn exported in the three years 1853, 1854, and 1855, was, in round numbers, £31,000,000; of woolen and worsted goods and yarn, the average exports for three years amounted to £10,000,000. The number of children employed has decreased considerably in flax and woolen factories, while it has increased in worsted. The total number of children under 13 years of age employed in all kinds of factories last year amounted to 46,071; the number of males between 13 and 18 to 72,220; the number of females above 13 to 387,826; and the number of males above 18 years to 176,400—making a grand aggregate array of 682,497. There were during the half year 1919 accidents from machinery, and 53 not due to machinery. The number of informations was 380, and the number of convictions 245. It is to be regretted that the accident list for the year shows the usual sad catastrophes.

* From the Practical Mechanics' Journal, May, 1857.

For the Journal of the Franklin Institute.

Particulars of the Steamer Cecile.

Hull and engines built by Harlan & Hollingsworth, Wilmington, Delaware. Intended service, Charleston to Savannah.

HULL.—

Length on deck,		161 feet.
Breadth of beam, (molded,)		29 "
Depth of hold,		10 "
" to spar deck,		18 " 1 inch.
Length of engine room,		66 "
Draft of water forward,		4 " 8½ inches.
" aft,		5 " 2½ "
Tonnage,	Hull, 438.	
"	Engine-room 212.	

ENGINES.—Vertical beam.

Diameter of cylinder,		38 inches.
Length of stroke,		10 feet.
Maximum pressure of steam,	35 lbs.	
Cut-off,	5 feet.	
Maximum revolutions at above pressure,	24.	
Weight of engines,	120,000 lbs.	

BOILER.—One—Return flued.

Length of boilers,		22 feet.
Breadth " front,		10 "
" " shell,		9 "
Height " exclusive of steam chimney,		10 "
Weight " with water,	90,000 lbs.	
Number of furnaces,	2.	
Breadth "		4 " 3 inches.
Length of grate bars,		5 " 6 "
Number of flues or tubes,	above 12, below 8,	
Internal diameter " "	above six of	12 "
	"	10 "
Length of " "	above	17 " 2 "
	below	13 " 5 "
Heating surface,		1264 sq.ft.
Diameter of smoke pipe,		50 "
Height " from grate,		45 feet.
Consumption of fuel per hour,	½-ton.	

PADDLE WHEELS.—

Diameter over boards,		24 "
Length of blades,		7 "
Depth "		22 "
Number "	20.	

Remarks.—Frames—sketch of shape **I**, depth 3 ins × ¾-ins. Number of strakes of plates from keel to gunwale 10; thickness of plates 3-8—5-16—1-4 inch. Description of cross-floors, nine, 15 ins. deep of 5-16 plates. Depth of keel 4; diameter of rivets 5-8; distance apart 2 ins. Single riveted on strakes. Independent steam, fire, and bilge pump, 1; bulkheads, 3; 8 keelsons, 30 inches deep by 12 ins. wide. Main deck open aft, saloon deck and cabin. C. H. H.

*The Abbé Pauvert's Improvements in the Manufacture of Iron and Steel.**

Considerable curiosity has been expressed in reference to the inventions of M. L'Abbé Pauvert, of Chatellerault, France, in consequence of an exciting notice which appeared some time since in the letter of the Paris correspondent of the *Times*. We take the earliest opportunity, therefore, of making known the nature of these improvements in the manufacture of iron and steel. The inventor has obtained patents for three inventions in this country. The first—for "certain improvements in manufacturing iron"—is thus described by him:

"The object of this invention is to deprive or drive off from puddled iron sulphur, phosphorus, and other metalloids, by cementation; it is applicable to puddled iron in any of its stages or states. I employ a cement composed of the following substances:—14 parts (by weight) oxide of iron; 30 highly aluminous clay; 50 carbonate of lime or wood ashes; 4 finely divided charcoal; 1 carbonate of potassa; 1 carbonate of soda. These proportions need not be rigorously adhered to, but may be varied, and one or more of the substances composing the cement may be dispensed with, according to circumstances and the nature of the iron. I place the iron with the cement in layers into a cementing furnace, and I heat the furnace in the ordinary manner. This iron, after cementation, is welded, and then drawn into bars. It thus becomes as soft and as tenacious as iron made with charcoal. The many electric currents produced by the mutual reaction of the elements, the reduction of the earthy and alkaline metals, and of a portion of the oxide of aluminum, favor the escape and the absorption of phosphorus, sulphur, and other metalloids. In order that all the carbon may be decomposed and disappear in the state of oxide or carbonic acid, it is necessary that the carbonates and oxides should be in excess."

The second invention—for "certain improvements in manufacturing cast steel"—he thus describes:

"The object of this invention is to decarbonize cast iron by prepared oxide of iron, and to free it from gaseous and solid metalloids. I crush cast iron heated to a red heat under rolls, or under a tilt hammer, or broad faced forge hammer. The portion of the cast iron reduced to a fine powder serves for the preparation of the oxide, while that which is in coarser particles serves for reguluses or metal. To render the oxydation complete, the powdered cast iron is wetted with pure, acidulated, or alkalized water. To obtain cast steel I have recourse to the processes and apparatuses now used for fusing. I place in a melting pot from 33 to 40 parts (by weight) of oxide prepared as just stated, to 100 parts of crushed cast iron to every 100 parts cast iron; 8 or 10 parts of the following composition are added (which must be kept as free as may be from exposure to the air): 4 parts (by weight) dry carbonate of soda; 4 dry carbonate of potash; 3 wood ashes; 2 borax; 3 oxide of manganese; 4 to 7 hydrogenated carbon, soot, or lamp-black. These ingredients should be carefully mixed, but the number and proportions may be varied according to the product desired. Instead of oxidyzed cast iron, iron filings or iron raspings may be used, the same being oxydized by the same process. Instead of 4 parts dry carbonate of potass, 2 parts caustic potass may be employed. The numerous reactions of these ingredients produce the following effects:—1. The generation of numerous electric currents. 2. Complete reduction of the manganese and oxide of iron (produced by the oxydized cast iron or iron filings) which unite with the steel. 3. Reduction of the earthy and alkaline metals and borax which absorb the metalloids. 4. Disappearance of the *nitrous* gases, because potassium, sodium, and calcium reduced in presence of steel and of carbon in an incipient state absorb *nitrogen* and form cyanides of potassium, sodium, and calcium. 5. Formation of larger crystals in the steel, when it cools down, than have hitherto been produced in steel."

The third invention—for "certain improvements in manufacturing steel and cast steel"—he describes as follows:

"The object of this invention is—1. To purify iron, and to combine it chemically with carbon by cementation. 2. To convert it into cast steel of superior quality, whatever the nature of the iron first employed, I make use of a cement composed of the

* From the Lond. Mech. Mag., September, 1857.

materials and in about the proportions following:—33 parts (by weight) of finely divided charcoal; 33 parts of highly aluminous clay; 33 parts of carbonate of lime or wood ashes; 1 part carbonate of soda; 1 part carbonate of potash. I stratify the iron with this cement in an ordinary cementing furnace, and heat it in the same manner as is now generally followed. I thus obtain a steel possessing all the qualities of that known as German, or 'Rives,' or shear steel (*acier d'Allemagne ou de Rives*). The successive heats and firings do not cause it to part with the carbon which is intimately combined with it, as in cast or in shear steel. And for this reason, carbon having but a small affinity for iron, requires, in order to enter into intimate combination with it, 1st, to be added in an incipient state; 2d, to be assisted in its combination by numerous electric currents. Now these conditions are fulfilled by my process, for—1st. The mutual reaction of the carbon and the carbonates causes the greater part of the carbon to assume a molecular state; 2d. This *change* of the carbon and of the carbonates, the action of the red-hot iron upon the oxides of aluminum, of calcium, of potassium, of sodium, with the carbon in the molecular state, produce or generate numerous currents of electricity. Further, the earthy and alkaline metals appearing in an incipient state, greedily absorb sulphur, phosphorus, and the other metalloids. Thus prepared, this steel may be used as shear steel or German steel (*acier d'Allemagne*), the properties of which it possesses. In order to convert this steel into cast steel, the ordinary processes of fusing in pots is followed, but with the addition to the metal in the pots of from five to six per cent., by weight, of the following mixture, which, as far as possible, must be kept from contact with the atmosphere:—4 parts (by weight) dry carbonate of soda; 4 parts dry carbonate of potash; 3 parts wood ashes; 2 parts borax; 3 parts oxide of manganese; 4 to 7 parts hydrogenated charcoal, soot, lamp-black, &c. The four parts of carbonate of potash may have substituted for them two parts of caustic potash. The mixture of these substances should be effected with care, and their number and proportions may be varied to suit the nature of the products to be obtained."

The reactions of these substances are said to be the same as in the former case.

For the Journal of the Franklin Institute.

Improvement of the Ohio River. Reply to some Remarks of Mr. Ellet.

By W. Milnor Roberts, Civ. Eng.*

In the October number of the *Journal*, Mr. Charles Ellet, Jr., Civ. Eng., invites my attention to an "error" or "oversight," as he terms it, in my paper in the treatment of the question of saving water on the reservoir plan, by means of a modification of Mr. Haupt's plan of low open dams. He, however, disclaims any "wish to participate in the discussion now going on in the *Journal*," &c. In briefly replying, I desire it to be understood, therefore, as entirely separate from, and outside of, the paper now in the course of publication in the same *Journal*.

Mr. Ellet's remarks are calculated, though of course undesignedly, to convey a very erroneous impression as to my position in the controversy. I am not the *advocate* of low dams to be fed with reservoirs. I am the advocate of a regular slackwater navigation to be composed of locks and dams, and not at all dependent on artificial reservoirs, or artificial supply of any kind. At most, I have merely suggested that the plan of low open dams should be retained in the discussion, as auxiliary to the reservoir plan; all of which is directly antagonistical to my own. Here is what I said, in the September number referred to by Mr. Ellet:—"If it can be established beyond question, that this plan (low open dams), as compared with Mr. Ellet's, of keeping up the flow of the unobstructed river, may save two-thirds of the cost of the artificial reser-

* Received too late for insertion in its proper place.—Editor.

voirs, that fact might lead to its adoption as an economical *adjunct to the system of artificial reservoirs*, in case they should be deemed preferable to locks and dams." But I beg to decline being held up as the *advocate* of any plan in any degree connected with artificial reservoirs for making a navigation on the Ohio. My plan is, locks and dams.

At the same time, I may be permitted to add, that the *ipse dixit* of Mr. Ellet, or of any one, is not likely to settle the mooted points. The idea of having a river "standing on an inclined plane," belongs to Mr. Ellet; it is not an invention of mine. I did not even suggest that the river would present a uniform plane, with the system of open dams; nor will it do so, except in floods. If Mr. Ellet will carefully consider the entire question, as stated, keeping in mind that the river is already but a succession of deep pools and ripples, or natural dams, he may yet find that the low open dams would create a navigation about 6 feet deep, with *very much* less water than would be required to keep up the same depth along the unobstructed river. He will observe, that I have not contended that with the open dams in operation, the water would be raised five feet above its original natural plane, on all parts of the river.

He says, "I do not wish to enter into detailed investigation of this problem." To which it may be added, that it is not necessary, at present. But hereafter, should the slackwater plan be discarded in favor of the artificial reservoirs, then the problem will be investigated in detail; when it will perhaps be found to present a new problem. But even should it hereafter be *proved* that such open dams would not save water enough to warrant their use as *adjuncts to the reservoir system*, it would not militate in the slightest degree against the slackwater navigation, the only plan advocated by me, which would rest as before, on its own merits, notwithstanding Mr. Ellet's assertion, at the close of his communication, that locks as well as dams are "*unnecessary*." Any one, with equal propriety, may arrogate the right to assert that *reservoirs* are unnecessary, but I claim no such privilege in a public discussion of this character, because these are the *very points* under consideration: another tribunal must decide who is right, and point out the *corrections* that ought to be made in any of the views the different parties may have expressed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 15, 1857.

John C. Cresson, President, in the chair.

John F. Frazer, Treasurer, present.

B. Howard Rand, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Statistical Society of London; L. A. Huguet-Latour, Esq., Montreal, Lower Canada; The Regents of the University of the State of New York, Albany, New York; Hon. James H. Campbell, U. S. Congress; Hon. J. Holt, Commissioner of Patents, Washington City, D. C.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of September was read.

The Board of Managers and Standing Committees reported their minutes.

New candidate for membership in the Institute (1) was proposed, and the candidates (3) proposed at the last meeting were duly elected.

Mr. Marshall exhibited a machine for holding shoes while being manufactured, and intended to facilitate the operations of the workman, and to relieve him from the stooping posture he is compelled to assume when this work is held between the knees. It consists of a tripod, which sustains a vertical post of iron, surmounted by a flat smooth piece, upon which the leather is hammered. Near the top of the post an arm of U shape, is pivoted at one extremity, so as to revolve parallel with the post, and which is balanced to remain in any desired point of its revolution, by a strap of india-rubber attached to a fixed part of the post, and a pin in the crank keyed on the pivot. A vise is attached to the outer end of the U arm, and is ingeniously contrived to hold a last of any length, and in such a way as not to interfere in the slightest manner with getting at the leather of the shoe. The post is telescopic to suit any height; and the workman can sit or stand, as he prefers.

The machine has been submitted to the Committee on Science and Arts, for an investigation into its merits, and their report, which may be looked for in this *Journal*, will contain a more complete description of the machine.

Mr. Howson exhibited specimens of Mr. Newell's Photograph Portraits.

The process by which these pictures are produced, is the discovery or invention of Mr. Robert Newell. They are made by crystallizing a photograph or other picture on paper, and securing the photograph thus prepared between two plates of glass by a transparent cement, which renders the whole impervious to air or dampness, securing durability in any climate. The coloring is then applied, which, being transmitted through this transparent medium, produces the peculiar softness and natural appearance of texture, while it preserves every line, expression, and feature precisely as taken by the camera. The whole effect is to produce a picture more exact in tints, shadows, and colors, and more perfect in its minutest details, than has heretofore been obtained; at the same time there is a roundness and stereoscopic appearance which no other picture possesses without the aid of the stereoscope itself.

Mr. Jones exhibited a Fabric for Ladies' Skirt Hoops, invented by Mr. Pickering, of Cincinnati. It consists of a spiral spring, the interstices of which are filled with cotton or other like substance, so as to form a foundation for an exterior knitting, which is accomplished by the ordinary bobbin knitting machine.

Mr. Jones exhibited a specimen of sleeve fasteners, invented by B. F. Grinnell, of New York and Jersey City. Mr. Jones observed that there was a curious history attending this simple invention, that an interference

had been declared by the Patent Office, that hundreds of miles had been traveled over to procure testimony, which occupied over 700 pages, and the arguments upward of 120 pages.

The Patent Office has awarded priority to Mr. Grinnell.

Mr. Howson exhibited the following inventions:

1. A new ash-sifter, which, by means of peculiarly formed rockers, effectually agitates the ashes.

2. A square having a mitre formed on the handle; invented by Mr. Morse, of this city.

3. A governor of peculiar construction, by which an extended amount of direct lift may be obtained; invented by Mr. Van Velthroven, of this city.

4. A new cutter for wood turning lathes, which can be readily sharpened by simply grinding, and without the necessity of resorting to the forge for the purpose.

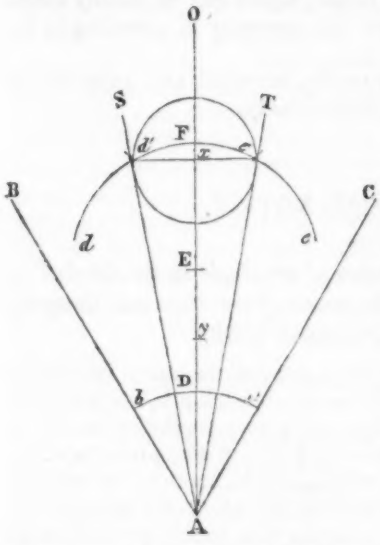
5. A machine for measuring dry goods, invented and patented by William Wythes, of St. Clair, Schuylkill County.

BIBLIOGRAPHICAL NOTICE.

Solution of the Problem of the Trisection of an Angle by the simple Processes of Geometry; that is, solely by means of the Rule and Compass. By B. DE VILLEROI, Bordeaux: A. Pechade. 1856.

We owe to the kindness of the author, a copy of the above interesting pamphlet, and as he appears to desire an opinion upon it, we will take the liberty of expressing one. The opening paragraph shows that M. de Villeroi's claim is no small one. Listen to him. "The problem of the trisection of an angle by the simple processes of Geometry, has been for a long time sought by the ancient geometers, *and abandoned as impossible by the moderns*, who have ranked the solution with equations of the third degree. But in mathematics, as in every other science, the last word is not yet said. *Learned men should often, if not from modesty, at least from circumspection, substitute in their decisions* the *word 'undiscovered'* for *'impossible.'* Galileo, Christopher Columbus, Franklin, Mongolfier, Fulton, and others, frequently gave the lie, not to science, but to scientific bodies. The same will be the case for the trisection of an angle, ranked by learned men with the philosopher's stone, perpetual motion, and the quadrature of the circle, and which, notwithstanding the authority of academies, and the influence of centuries, is about to descend from the region of the third power, to the humble and simple manœuvre of the rule and compass. I will leave to great mathematicians the development of the scientific theory, the corollaries, and all the consequences of this famous problem, submitting to them merely my practical observations. Satisfied to be able to present the material fact of the solution, and to be able to say, *as Archimedes did for the square of the hypothenuse:* "*I have found it—I have found it.*"

Now, we will not go into the inquiry as to whether the abovementioned great men ever gave the lie to anything or any body; nor as to whether Archimedes found the law of the square of the hypothenuse, which is generally attributed to Pythagoras, but we cannot help remarking that M. de Villeroi's ideas of the problem appear to be confused. A solution of the problem by rule and compass is not a *geometrical* but a *mechanical* one, and has, so far as we are aware, never been sought at all; nor do we see that the present mode is any better than the one long known, of laying off the angle from the scale of chords, which is as easily done. What ancient and modern mathematicians have sought, is precisely what M. de Villeroi, let us be permitted to say, has *not found*, a *demonstration* of some simple mode of trisecting an angle.



But we have a still more serious objection to M. de Villeroi's problem; not only he cannot show it to be right, but we, having no claims to be considered a great mathematician, can show it to be wrong.

His method is as follows: bisect the given angle C A B, by the straight line A O, and on this line set off A D, D E, and E F equal to each other, with the centre, E, and distance, E F, describe an arc, and from F, lay off the arcs, F d', F e' equal to D b and D c: draw the chord $d'e'$, cutting A O in x: with x as a centre and radius equal $x\,d'$, describe a circle, and draw the tangents to this circle A S and A T from the point A. According to M. de Villeroi, S A T is the third of B A C.

Now calling the angle B A O $=a$, and S A O $=b$: we have by trigonometry.

$$\sin b = \frac{\sin a}{2+\cos a} \text{ or } \frac{\sin a}{\sin b} = 2+\cos.\, a.$$

Also, by the well-known trigonometrical formula, $\frac{\sin 3b}{\sin b} = 3-4\sin^2 b.$

Then if $b=\frac{a}{3}$ we have $(1-4\sin^2 b)(\cos b-1)=0.$

Which can only be true when $b=0°$, 30° or 150°. $a=90°$.

The maximum error occurs when $a=72°$ about.

Are we then asking too much of M. de Villeroi, in advising him in his own language, "if not from modesty, at least from circumspection," to substitute in his decision the words "*I thought I had found*," for "*I have found*."

Abstract of Meteorological Observations for August, 1857, made in Philadelphia, Somerset, Huntingdon, and Northampton Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

Abstract of Meteorological Observations for August, 1857, made in Philadelphia, Somerset, Huntingdon, and Northampton Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

August, 1857.	Philadelphia.—Lat. 39° 57′ 28″ N, Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.									Somerset, Somerset Co.—40° N., Lon. 79°3′W. Height about 2750 ft. Geo. Mowry, Observer						Huntingdon, Huntingdon County. Jacob Miller, Obsr			Easton, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16W. Height above the sea about 320 feet. Selden J. Coffin, Observer.					
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain.	Prevail'g winds.	Barometer.		Thermomet'r.		Rain.	Prevail'g winds.	Ther.	Rain.	Prevail'g winds.	Barometer.		Thermomet'r		Rain.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily range.	Mean daily range.	2 P.M.	2 P.M.			Mean.	Mean daily range.	Mean.	Mean daily range.			Mean.			Mean.	Mean daily range.	Mean.	Mean daily range.		
	Inch.	Inch.	o	o	=	Per.ct.	Inch	Inches.		Inch.	Inch.	o	o	Inches.		o	Inch.		Inch.	o	o	o	Inch.	
1	29·690	·086	77·3	17·0	5·5	56	·635		S W.	27·585	·048	67·3	3·4	0·034	S W.	69·0		W.	29·347	·090	72·3	4·3	0·04	S.
2	29·735	·046	79 3	17·0	3·3	41	·492		N W.	27·650	·061	64·0	3·3		N W.	68·0		W.	29·417	·070	68·7	3·7		N W.
3	29·825	·090	79·7	19·0	1·0	44	·530		S W.	27 676	·030	69·3	5·3		S.	72 0		(var.)	29·497	·080	70·7	2·0		S W.
4	29·768	·073	79·8	18·5	1·5	50	·628	2·568	S E.	27·617	·058	68·0	6 7	0·424	S.	76·0	0·065	S.	29·433	·077	72·3	1·7		S E.
5	29·670	·112	74·0	5·0	5·8	81	·704	0·260	N.	27·585	·062	67·0	5·7	0·297	N.	69·0	0·069	N.	29·320	·127	70·0	4·3	0·99	(var.)
6	29·865	·195	74·0	7·0	0·7	68	·614	0·431	S W.	27·724	·140	66·0	2·0	0 004	N E.	70·5		N E.	29·543	·223	72·3	2·3		S E.
7	30·009	·144	76·3	18·0	3·0	52	·571		S E.	27·822	·098	68·3	3·3		S S E.	72·0		S.	29·703	·160	73·0	0·7		S.
8	29·984	·037	75·8	17·0	0·5	49	·533		S.	27·824	·008	73·3	5·0	0·021	W.	78·0		S.	29·653	·050	71 0	2·0		W.
9	29·880	·104	78·2	14·5	2·3	61	·717		E.	27·757	·068	72·3	3·0		N W.	76·0	0 241	N.	29·540	·113	74·7	3·7	1·02	(var.)
10	29·664	·216	74·2	7·5	4·3	83	·724	2·767	S E.	27·459	·267	67·3	5·0	1·500	W S W	67·5	1·626	S.	29·310	·230	67·7	7·0		S E.
11	29·605	·154	75 0	19·5	6·2	54	·602		W N W	27·542	·162	67·0	1·7	0·034	W.	68·0		W.	29·220	·150	69·7	5·0	0·22	W.
12	29·871	·266	78·7	15·5	3·7	54	·602		(var.)	27·712	·169	71·0	4·7		W.	71·5		N W.						E.
13	29 809	·101	83·7	18.0	5·0	55	·788		S W.	27·740	029	74·3	3·3		W.	82 5		W.	29·477		78·2			(var.)
14	29·714	·095	87·0	19·0	3·3	52	·832		S W.	27·700	·040	76·3	3·3	0 974	W.	81·0	0·020	W.	29·393	·083	80·2	2·0		N W.
15	29·701	·053	84·2	14·0	3 8	61	·847	0·578	W.	27·666	·034	75·3	1·0		W.	73·0		N.					0·12	(var.)
16	29·888	·186	77·5	11·0	6·7	51	·564		(var.)	27·723	·157	69·0	6·3	0·116	N.	75·5		N.	29·573					(var.)
17	29·829	·097	77·2	14·0	0·7	67	·730	0·372	(var.)	27·664	·059	74·0	5·0	0·123	W.	78·0	0·457	W.	29·457	·117	70·0		0·40	S E.
18	29·786	·080	73·0	10·0	4·2	63	·582	0 019	(var.)	27·667	·031	66·3	7·7	0·741	W N W	65·0	0·026	N.	29·450	·073	67·0	3·0	0·01	(var.)
19	29·838	·053	71·8	15·0	2·8	56	·515		S E.	27·728	·061	64·3	5·3		W.	66·0		W.	29·513	·063	67·5	2·8	0·01	(var.)
20	29·878	·040	72·2	16·0	1·0	46	·442		W N W	27·760	·035	58 7	5·7		N W.	64·5		N.	29·577	·063	64·0	3·5		W.
21	29·945	·067	72·5	18·0	0·7	47	·464		N.	27·789	·051	62·0	5·3		S.	64·5		N W.	29·637	·060	63·3	2·7		(var.)
22			71·2	17·0	2·0	57	·549		N E.	27 559	·230	62·3	2·3	0·124	(var.)	65·0	0 300	S.	29·487	·150	66·8	3·5	0·01	S W.
23			71·0	15 0	0·8	54	·536		(var.)	27·513	·099	58·0	4·3	0·014	W.	60·0	0·044	W.	29·233	·253	66·3	0 8		S W.
24			66·0	15·0	5·0	54	·442		W.	27·739	·226	55·3	5·3		(var.)	58·0		N W.	29·467	·233	61·7	4·7		(var.)
25			67·8	15·0	1·8	51	·463		W.	27 885	·146	59·3	8·0		S.	58·0		S E.	29·740	·273	63 0	6·0		S W.
26			70·2	18·0	2·7	50	·499		S.	27·853	·040	65·3	6·0		(var.)	70·5		S.	29·757	·043	64·7	1·7		S W.
27			69·5	13·0	2·7	60	·540	0·844	S.	27·618	·235	66·0	7·3	0 676	S.	63·0	0·973	S.	29·570	·173	67·7	3·7	0·64	S E.
28			78 0	16·0	8·5	49	·588		S W.	27·505	·122	64·0	3·3	0 018	W.	66·5		W.	29·260	·310	72·0	4·3		(var.)
29	29·650		75 0	18·0	3·0	62	·636	0·200	(var.)	27·578	·073	60·0	4·0	0·028	W N W	65·0	0·495	W.	29·293	·033	66·2	5·8		W.
30	29 869	·219	70·5	17·0	4·5	47	·428		N W.	27·785	·207	55·3	4·7		(var.)	58·0		N.	29·520	·227	60·8	5·3		W.
31	30 005	·136	72·3	21·0	3·2	49	·481		N W.	27·880	·094	58·7	7·3		W.	65 0		N.	29·672	·153	64·7	5·5		W.
Me'n			75·3	15·3	3·2	56	·590	8·039	s 63¼w	27·688	·098	66·0	4·7	5·128		68·9	4·316		29·482				3·46	
Me'n for summer.	29·761	·093	74·6	44·0	3·4	57	·576	18·838	s.47°w															

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.

Thermometer for July.

Barometer for July.

EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" ·—·— Northampton " " <—> Huntingdon "